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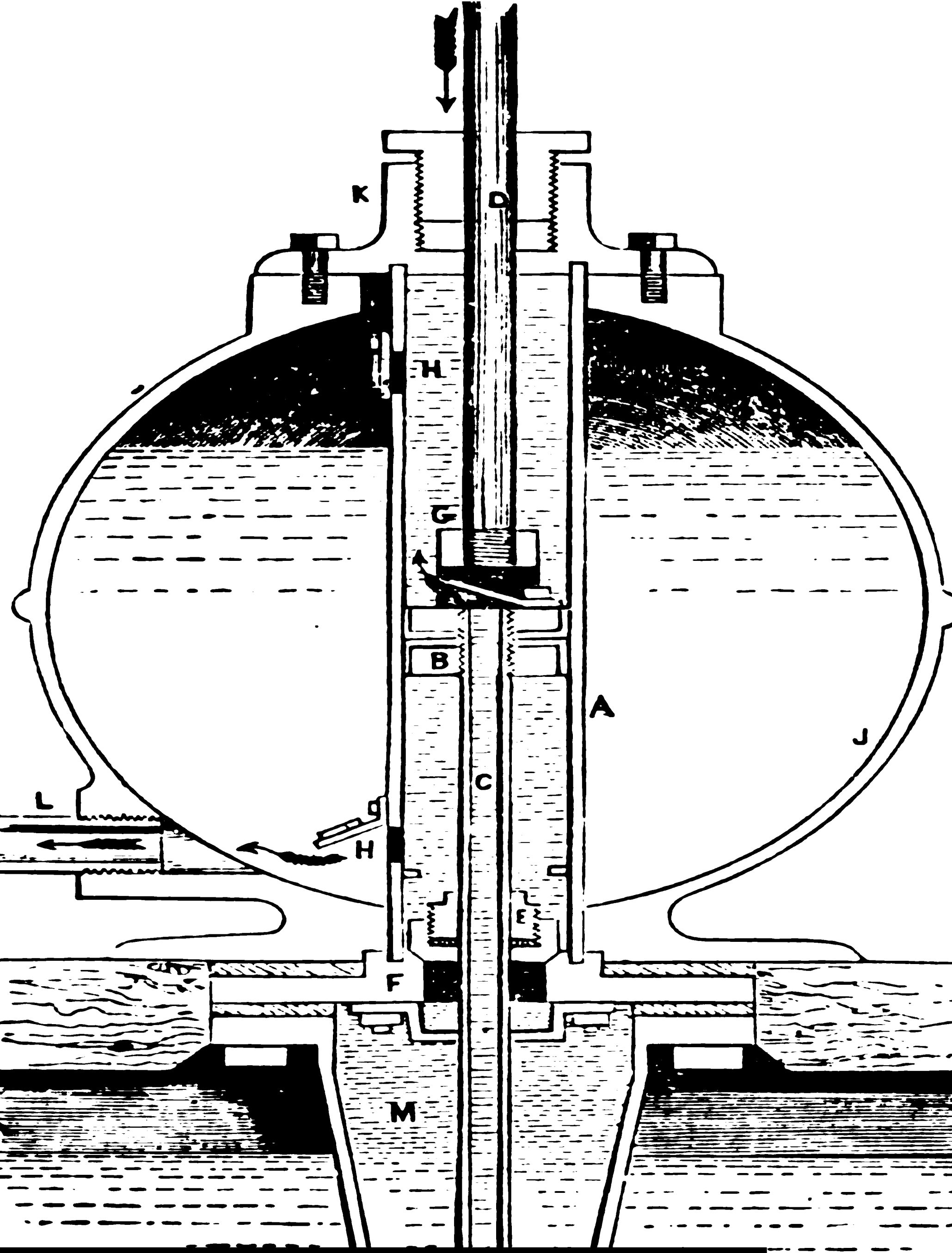

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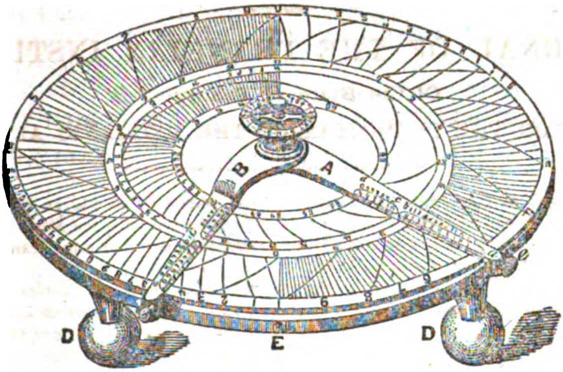

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JULY, 1855.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Description of a Dredging Machine Invented and Patented by D. S. Howard, *of Lewis County, N. Y., with some Notes made at a trial of it at Whitehall, Washington County, N. Y.; accompanied by some formulæ and rules for calculating the effect of Dredging Machinery.* By John W. Nystrom.

The dredging machinery represented in the accompanying plates, is worked by a pair of horizontal high pressure steam engines.

Plate I. represents a side elevation of the machine, showing the buckets drawn up on one side to the full height above the water line, and those on the other side let down to the full depth of excavation.

Plate II. is an end view of the same, showing the buckets down on the starboard side, and up on the port side above the water line.

Plate III. is a plan of the dredge, showing the steam engines and the method of transmitting the motion from them to the dredging machinery.

The power from the steam engine is transmitted through the main shaft *e*, and chain wheel *s*, over which is placed the joint chain I, passing over a second chain wheel *l*, by which the motion is transmitted to the pinion H, and cog-wheel J. The bucket chain *t*, passes over a pair of chain wheels fitted on the same shaft with the cog-wheel J, by which, motion is given to the buckets.

The two engines are connected by a link *r*, so that the cranks G G, are at right angles. The dredging machinery is the same on each side of the boat.

The driving chain I, and bucket chain *t*, are composed of alternate links of wrought and cast iron riveted together by steel bolts, so that the pitch of the chain is equal to the pitch of the studs on the chain wheels, which studs fit into the *wrought* iron links of the chain. The buckets and bucket chain pass from the driving chain wheels K K, over a pair of flanch wheels M M, situated on a car movable on the inclined plane X; the buckets and bucket chain then pass down to the place of excavation, under another pair of chain wheels Q, where the buckets dig their loads, and are drawn up by the driving chain wheels K K, over which the buckets with their excavated material pass to the place where it is unloaded.

The buckets have the side nearest to the chain made like a door, latched to the bucket, when full; on the chain wheel shaft K K, is a latch wheel which unlatches the door, and the excavated material, of its own weight, falls into the spout N, and passes off into a scow placed underneath for the purpose, while the empty bucket, with its door open, continues its motion over the flanch wheel M M, where the door is closed by the wheel P, and the bucket goes down for another load.

The lower chain wheel under which the buckets excavate are supported by a wooden framing called ways. Those ways are guided by friction rollers at the top, and by the rack arm S, at the lower end. The buckets and ways are raised or lowered by moving the car U, up or down on the inclined plane X, which motion is either operated by hand or steam power. For hand, the windlass *u* is worked by the crank T, pinion and wheel V; when worked by steam power, the pinion is thrown into gear with both the wheels U and V, the wheel U, which is fast on the flanch wheel shaft, transmits the motion through the pinion to the wheel V, and windlass *u*, by which the car is wound up or lowered on the inclined plane X, and the buckets with the ways are raised or lowered to suit the depth of excavation, or can be raised up above the water line when required.

The dredge can be fed (moved ahead) in three different manners while excavating. *First*, by a kedge anchor placed at a suitable distance ahead of the dredge; in this anchor is fastened the hemp cable *g*, extended to and wound up on the windlass *f*, which is worked either by hand, by the crank *v* and pinion *w*, or by steam power working the pall *y* in the cog-wheel *w*. The pall receives its motion from the eccentric and lever *x*. This is the most general mode of feeding the dredge when long distances are to be excavated. For short distances, the feeding is done (*secondly*) by the rack arm S, which receives its motion from the crank *c*, connecting rod *d*, and lever *b*, on which latter is a double pall working into the wheel *a*, and by a pinion gearing into the rack arm S; the ways R, with the lower chain wheel Q, can be pushed forward, while the dredge boat is at anchor; and, *thirdly*, the dredge can be fed by the ropes *b′ b′*, attached to the bow and stern anchors *h h*.

The bow and stern anchors *h h*, are secured sideways above the deck of the boat and at the lower guards, but are allowed to move at the bottom fore and aft about fifteen feet, which allows the dredge to move that distance towards the kedge anchor by feeding in the cable *g*, and the dredge will be confined in a lateral direction, as the anchors are guided sideways.

The anchors *h h*, are raised either by a hand lever or by steam power, the ropes *o o*, passing round pulleys to bring them in a right direction for the capstans *p p*, by which the anchors are raised.

United States Dredge Machine at Whitehall, N. Y.

In March, 1853, the Bureau of Topographical Engineers contracted with Mr. Howard for the construction of four dredge boats for service in Lakes Champlain, Ontario, Erie, and Michigan.

These boats, in addition to the dredging machine, were required to be provided with locomotive power, in order that they might be transferred from harbor to harbor, as the necessity of the service might require.

The one for Lake Champlain was prepared for inspection and delivery by November, 1853, and the Bureau assigned this duty to Lieut. George G. Meade of the Corps of Topographical Engineers.

This officer has furnished a report of the performance of the dredge under inspection to the Bureau.

The following is a summary of my notes made under the same inspection.

Dimensions of the Dredge Boat.

Length in clear,		123 feet.
Length from centre of rudder to outer side of stem,		109 " 6 inches.
Breadth of beam,		26 " 1 "
" " over all,		41 " 1 "
Draft of water forward,		2 " 7 "
" " aft,		3 " 1 "
Mean draft,		2 " 10 "
Greatest immersed section,		68 square feet.
Tonnage of displacement,	141 tons.	
" Custom house measurement,	157 "	

Two horizontal high pressure engines.

Diameter of cylinders,	12⅛ inches.
Stroke of piston,	4 feet.

Two cylindrical boilers placed side by side half surrounded by brickwork forming the first flues.

Length of boilers,	20 feet 3 inches.
Outside diameter,	3 " 4½ "
Two flues in each boiler. Inside diameter,	14⅜ "
Total heating surface in both boilers,	617 square feet.
" fire grate " "	37 " "
Area of draft to fire grate,	6 " "

The boat was provided with paddle wheels to move her from place to place, the paddle wheel shaft being connected to the main shaft by couplings, so that the wheels could be worked together or separately.

Extreme diameter of paddle wheels,		15 feet.
Number of floats in each,	14.	
Each float 5 feet wide by 15 inches deep,		= 6·25 square feet.

Dredging Machinery.

There are two sets of buckets, one on each side of the boat, as represented on the accompanying plates. The buckets are connected by two chains of alternate wrought and cast iron links; the wrought iron links are 8 inches between the centres, by ½-inch thick, forming the space for the studs on the chain wheels, while the cast iron links are 6 inches between the centres, by 2½ inches thick, fitting between the studs. The wrought iron links are riveted, one on each side, by steel pins, to the ends of the cast iron links, making the pitch of the chain $8+6=14$ inches, and five pitches = 5 feet 10 inches between each bucket.

The buckets are made of ¼-inch boiler iron, 2 feet 6 inches by 1 foot 3 inches at the top and 2 feet deep, making the capacity of each bucket 6¼ cubic feet.

The following TABLE contains the result of a day's work of the dredging machine in South Bay, Whitehall, New York, November 12, 1853.

No. of operations.	Time by watch.		Operating time in minutes.			Cubic yards per		Depth in feet of			Feeded feet per		Steam Engine.			Excavated materials in tons per hour.	REMARKS.
	Commenced.	Stopped.	Excavating.	Emptying scows.	Total.	Operation.	Minute.	Excavating.	Water.	Excavated channel.	Operation.	Minute.	Revolutions.	Steam.	Horse power.		
	H. M	H. M.												lbs.			
1	9 20	9 35	15	4	19	40	2·85	11	8	3	70	4·65	38	30	21·6	139	Soft clay.
2	9 39	9 53	14	3	17	35	2·50	11	8	3	51	3·64	37	20	14·7	122	Do.
3	9 56	0 10	14	4	18	42	3·00	11	7 9	3 3	76	5·42	40	25	20·	146	Do.
4	10 14	10 27	13	4	17	42	3·23	11	7 9	3 3	60	4·61	40	25	20·	158	Do.
5	10 31	10 46	15	3	18	42	2.80	11	7 6	3 6	56	3·73	37	25	18·5	137	Do. softer.
6	10 49	11 02	13	2	15	44	3·38	11	7 6	3 6	53	4·07	38	20	15·2	155	Do. and vegetable matter.
7	11 04	11 17	13	3	16	47	3·61	11	7 3	3 9	52	4·00	39	20	15·6	166	Mud and very soft.
8	11 20	11 35	15	3	18	41	2·73	11	7 3	3 9	42	2·80	40	25	20·	125	
			1 h. 52 m.	36	2 h. 18 m.	333	2·97				460	4·10					Shifted the boat for a new start 30 min. Dinner 1 h.
	H. M.	H. M.	M.											lbs.			The two scows on one side.
9	1 05	1 16	11	2	13	44	4·00	11	8	3	50	4·53	48	25	24·	195	Common clay.
10	1 18	1 27	9	2	11	44	4·87	11	8	3	56	6·20	47	25	23·5	238	Do.
11	1 29	1 40	11	1	12	32	4·91	11	7 9	3 3	66	6·00	48	30	28·8	142	Some hard clay mixed with
12	1 41	1 50	9	2	11	44	4·88	11	7 9	3 3	78	8·64	50	35	35·	237	vegetable matter.
13	1 52	2 04	12	1	13	44	3.67	11	7 6	3 6	80	6·65	48	30	28·8	179	Found a log; raised up the
14	2 06	2 15	10	1	11	42	4·20	11	7 6	3 6	81	8·10	47	30	28·1	204	buckets on one side, Clay
15	2 16	2 28	12	2	14	42	3·50	10, 11,	7 3	3 9	66	5·50	44	40	35·2	165	and vegetable matter.
16	2 30	2 41	11	2	13	46	4·17	11	7 3	3 9	57	5·17	44	30	26·4	197	A crooked log about 3 feet
17	2 43	2 56	12	1	13	44	3·66	9, 10, 11,	7	4	50	4·16	40	30	24·	173	long by 7 inches diameter
18	2 56	3 15	19	2	21	46	2·42	11	7	4	67	3·52	38	30	22·8	114	came up in a bucket.
			1 h. 56 m.	16	2 h. 12 m.	428	3·68				651	5·60					Raised up the buckets on one side.
	H. M.	H. M.												lbs.			Shifted the boat for a new start.
19	3 57	4 08	11	1	12	46	4·18	11	8	3	60	5·45	39	25	19·5	203	Soft clay.
20	4 09	4 22	13	2	15	44	3·38	11	8	3	70	5·37	38	20	15·2	165	Do.
21	4 24	4 37	15	2	17	44	2·93	11	7 9	3 3	72	4·80	40	25	20.	143	Some harder clay.
22	4 39	4 50	11	1	12	46	4·18	10	7 9	3 3	69	6·26	46	25	23·	203	Do.
23	4 51	5 00	9	1	10	44	4·88	11	7 6	3 6	64	7·10	46	25	23·	238	Do.
24	5 01	5 15	14	5	19	44	3·14	11	7 6	3 6	84	6·00	47	25	21·5	153	
25	5 20	5 33	13	3	16	46	3·53	11	7 3	3 9	54	4·15	40	20	16·	172	
			1 26 1 56 1 52	15 16 26	1 41 2 12 2 18	314 428 333	3·65 3·68 2·97				473 651 460	5·50 5·60 4·10		Steam valve only ¼ open.			
Averages.			5 14	57	6 11	1075	3·42				1584	5·04	42		22	170	

In the first eight operations, two scows were used, one on each side of the dredge, to receive the excavated materials, and for each operation received the cubic yards noted in the 7th column. In the fifth column is noted the time occupied in moving and emptying the scows and replacing them for the next operation. The dredge is provided with four scows capable of carrying forty tons each, of which we had only two at South Bay. In order to occupy as little time as possible in conveying the excavated material away, both the scows were placed on the port side of the dredge, so that one could be emptied while the other one was being filled, and the excavated material on the starboard side was dropped into the Bay, supposing it to be the same quantity as on the port side, where it was measured by the scows, and its specific gravity noted.

Lieutenant Meade considered this day's work to have been a satisfactory test, and that the dredging machinery was capable of doing more than double the duty that the contract called for. The locomotive power of the boat still remained to be tried.

The locomotive power of the dredge boat was tested on Lake Champlain, November 16th, 1853. Started from Benson at 7 o'clock in the morning against a brisk wind, current about one-quarter of a mile an hour in our favor. Arrived at Barber's Point at 2 hours 7 minutes P. M., a distance from Benson of 39 miles. From Barber's Point we returned to Benson, where we arrived at 7 h. 56 m. the same evening.

The whole time from Benson to Barber's Point and back was	12 h. 56 m.
Of which time the engine was stopped, . .	0 54
Actual running time, . . .	12 h. 2 m.

A distance of 78 miles, making nearly $6\frac{1}{2}$ miles per hour.

The average pressure in the boilers was 100 lbs. per square inch. Cut off at half stroke. Paddle wheels made 20 revolutions per minute.

Diameter of the centre of pressure of the floats in the paddle wheels,	= 13·75 feet.
Circumference of the same, . . .	= 43·19 "

Distance moved through by centre of pressure $\frac{20 \times 43{\cdot}19 \times 722}{5280} = 118{\cdot}1$ miles nearly.

$$\text{Slip of paddles } \frac{78}{118} = 66{\cdot}04 \quad 100 - 66{\cdot}04 = 33{\cdot}96.$$

$$\text{Slip} = 34 \text{ per cent. nearly.}$$

Formulæ and Rules for Dredging Machinery.

The following formulæ and rules were deduced by me from the performances of a number of dredging machines built in Motala, Sweden, some of which have since been published in my Pocket Book of Mechanics and Engineering.

Letters Denote

T. = tons of materials excavated per hour.

h. = height in feet, to which the excavated material is raised above the bottom of the excavated channel.

H. = horse power required to excavate T. tons of material per hour.

k. = coefficient for the different kinds of materials, which have been found by actual performance.

Very hard clay mixed with gravel, .	$k = 0{\cdot}1$
Hard pure clay, .	$k = 0{\cdot}07$
Common clay or sand, .	$k = 0{\cdot}05$
Soft clay or loose sand, .	$k = 0{\cdot}04$
Very soft and loose sand, .	$k = 0{\cdot}03$

$$H = T\left(\frac{h}{700} + k\right) \qquad - \quad - \quad - \quad - \quad 1$$

This is the formula for finding the horse power required to excavate T. tons of material per hour, and raise it to feet.

Example 1.—A harbor of hard pure clay is to be excavated to 15 feet of water, the material to be raised 11 feet above the water line, making the height $h = 15 + 11 = 26$ feet; it is desired to raise $T = 250$ tons of clay per hour. Required the horse power necessary for the excavation?

$$H = 250\left(\frac{26}{700} + 0{\cdot}07\right) = 26{\cdot}785 \text{ Horses.}$$

Given the horse power, to find the quantity of materials that can be excavated per hour.

$$T = \frac{700\,H}{h + 700\,k} \qquad - \quad - \quad - \quad - \quad - \quad 2$$

Example 2.—A steam engine of 20 horses is to be used for a dredging machine to excavate a dock of common clay to 10 feet, the material is to be raised 9 feet above water line, making the height $h = 10 + 9 = 19$ feet. Required how many tons of clay can be excavated and raised per hour, $T = ?$

$$T = \frac{700 \times 20}{19 + 700 \times 0.05} = 259 \text{ tons.}$$

To find the power necessary to loosen the material without raising it. This will be found by the insertion of the height, $h = o$ in the formula 1, and will appear simply—

$$H = Tk \qquad - \quad - \quad - \quad - \quad - \quad 3$$

Example 3.—What power is required to dig loose, $T = 300$ tons of soft clay per hour, $H = ?$

$$H = 300 \times 0{\cdot}04 = 12 \text{ Horses.}$$

Example 4.—How many tons (T) of hard pure clay can be dug loose per hour by an engine of $H = 18$ horses, $T = ?$

$$T = \frac{18}{0{\cdot}07} = 257 \text{ tons.}$$

To find the resistance opposed to feeding the dredge by excavation. Let v = velocity of the buckets in feet per second, and

F = the force in pounds resisting the feed motion of the dredge, we shall have the force—

$$F = \frac{550\,H}{v} = \frac{550\,T\,k}{v} \qquad - \quad - \quad - \quad 4, 5$$

Example 5.—A dredging machine is to excavate, $T = 160$ tons of very hard clay per hour, and the velocity of the buckets $v = 0{\cdot}89$ feet per second. Required the force necessary to feed the dredge ahead, $F = ?$

$$F = \frac{550 \times 150 \times 0{\cdot}1}{0{\cdot}89} = 8269 \text{ pounds.}$$

If only one kedge anchor and cable is used for feeding the dredge ahead, the circumference of the cable should be

$$\text{Circumference} = \sqrt{\frac{9269}{120}} = 8{\cdot}78 \text{ inches, or } 2\tfrac{3}{4} \text{ inches in diameter.}$$

THE SAME LETTERS ON THE DRAWINGS REFER TO LIKE PARTS.

A,	Steam boiler.	N,	Spout.	*a*,	Spur wheel.	*n*,	Anch. hoistings,
B,	Safety valve.	O,	Latch wheel.	*b*,	Pawl arm.	*o*,	Anchor rope.
C,	Steam pipe.	P,	Door shut wheel.	*c*,	Crank.	*p*,	Capstan.
D,	Exhaust pipe.	Q,	Low. ch'n wheels.	*d*,	Feed con'ing rod.	*q*,	Anchor.
E,	Steam cylinder.	R,	Ways.	*e*,	Main shaft.	*r*,	Connecting link.
F,	Connecting rod.	S,	Rack arm.	*f*,	Driving shaft,	*s*,	Chain wheel.
G,	Crank.	T,	Crank.	*g*,	Cab. for ked'e an.	*t*,	Bucket chain.
H,	Driving pinion.	U,	Cog w'l } windlass	*h*,	Anchor.	*u*,	Car windlass.
I,	Driving chain.	V,	Cog w'l } windlass	*i*,	Lever.	*v*,	Feed motion cra'k
J,	Driving wheel.	W,	Chimney.	*j*,	Driving wheel.	*w*,	Pinion.
K,	Dri'g chain wheel.	X,	Inclined plane.	*k*,	Block & sheeves.	*x*,	Eccentric.
L,	Buckets.	Y,	Balance weight.	*l*,	Chain wheel.	*y*,	Pawl, feed motion.
M,	Flanch wheel.	Z,	Lever joint.	*m*,	Sheeves.	*z*,	Hatch.

AMERICAN PATENTS.

List of American Patents which issued from May 1, *to May* 29, 1855, (*inclusive*,) *with Exemplifications*.

MAY 1.

1. For an *Improved Ticket Register for Railroad Cars;* William Apperly, Louisville, Kentucky.

Claim.—" 1st, The improvement for distributing and registering railroad and other tickets, consisting in the combination and arrangement of the slide, spring, and register device, or its equivalent. 2d, Providing the extension and inclined way."

2. For an *Improved Fire Engine;* John R. Adams, Port Jervis, N. Y.

Claim.—" Having the cylinders placed radially in a band or ring, and encompassing said band or ring with a band or ring and cam, the band or ring and cam being allowed to rotate around the band or ring and cylinders, and operating the pistons of the cylinders, in consequence of their connexion with the cam."

3. For an *Improved Bullet Mould;* William Ashton, Middletown, Connecticut.

Claim.—" Having a conical aperture, made in a piece of metal, and having a projection or cone, and flanch, attached to a metal strip, which is secured to the shank handle of the mould by a pivot, so that said projection or cone, may be inserted in and withdrawn from the aperture."

4. For an *Improved Clothes-Pin Machine;* H. and M. Blake, Hartland, Vermont.

Claim.—" 1st, The employment or use of the holding cylinder and circular saw, when both are hung on permanent shafts, so that the cylinder rotates with a comparatively slow motion, compared with the saw, and conveys by a continuous rotary motion the clothes pins over against the saw, for the purpose of forming the grooves or slots therein. 2d, Securing the clothes pins in the holders of the cylinder by means of the clamps secured to the periphery of the cylinder, and operated by the rim or ledge and flanch, so that the clothes pins will be firmly clutched in the holders, while being operated upon by the saw and cutters, and allowed to fall therefrom when the grooves or slots are finished. 3d, The combination of the cylinder, saw, and cutters."

5. For an *Improvement in Wheelwrights' Boring and Tenoning Machine;* Chauncey Cowdry, Orrin Tolls, and Chauncey C. Tolls, Ithaca, New York.

Claim.—"1st, The combination and arrangement of the frame with the scale of graduated and sliding tubes and screw. 2d, The combination of the hinged support with the sliding screw clamp. 3d, The combined arrangement of the several parts."

6. For an *Improvement in Processes for Purifying and Cleansing Wheat;* Charles Campbell, California.

Claim.—"The preparation of lime for this particular purpose, and the application of it to wheat, when new slaked and warm, so as to much more effectually cleanse the wheat from all impurities than by any other process."

7. For an *Improved Machine for Bundling Fleeces of Wool;* John How, Deer Creek, Michigan.

Claim.—"In combination with the packing box, the adjustable straps, with their piece, and the levers, for pressing the bale, and furnished in a convenient position for the operator, the strings or cords by which the pressed fleeces are baled up."

8. For an *Improved Mode of Applying Eccentric Wheel to Water Power;* James B. Hurt, Nottoway County, Virginia.

Claim.—"The water wheel without arms or main shaft revolving on fulcrum wheels underneath, thereby lengthening out the lever power near the whole diameter of the wheel, the thick and thin interties shouldered and bolted to each rim, the cast segments bolted to middle rim, which gears into the cogs of wollower on horizontal shaft extending across on the inside of water wheel; also the two revolving fulcrum wheels, with flanches on the outside of each wheel, to keep the water wheel in its true position."

9. For an *Improvement in Shuttles for Looms;* Laroy Litchfield, Southbridge, Mass.

Claim.—"The backward extension of the heel of the spindle combined with the application of the spring above the said heel, and above and in rear of the pin, on which the spindle moves in such manner as to hold the spindle in its operative position, by throwing its heel upwards against a proper fixed bearing."

10. For an *Improvement in Shuttles for Looms;* Ezra P. Marble, New Worcester, Massachusetts.

Claim.—"Attaching the catch, which confines the bobbin or cop on the spindle to a pin, which works perpendicularly through the spindle, and is acted upon for the purpose of throwing, and holding the catch in operation by a spiral spring or its equivalent, and acted upon for the purpose of throwing the catch out of operation by coming in contact as the spindle is raised with a plate, or other fixed stop."

11. For an *Improvement in Horse Powers;* Clement Russell, Massillon, Ohio.

Claim.—"Providing a broad solid flanched box or centre for the axis to rest in, when said box is made in two parts, and fitted and confined by the axis itself, and flanches in an oblong slot formed in a bridge."

12. For an *Improvement in Corn Planters;* Presley Raines, London, Ohio.

Claim.—"The combination of elevator, sliding platform, and flaring plunger, operated simultaneously by the elevation and depression of the guiding handles."

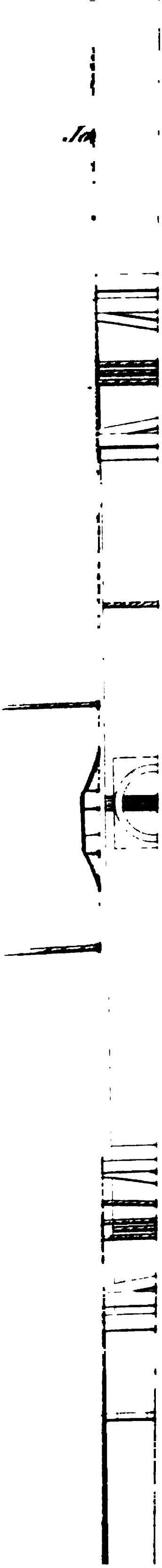
13. For an *Improvement in Alarm Attachment for Door Locks;* John Schneider, Rochester, New York.

Claim.—"The employment or use of the barrel, hammer, with plate attached, spring, and tumbler."

14 For an *Improvement in Window Sash Supporter;* David Russell, Drewersburg, Ia.

Claim.—"1st, The curved form of the stop fasteners. 2d, The offset in combination with the fasteners."

Journ



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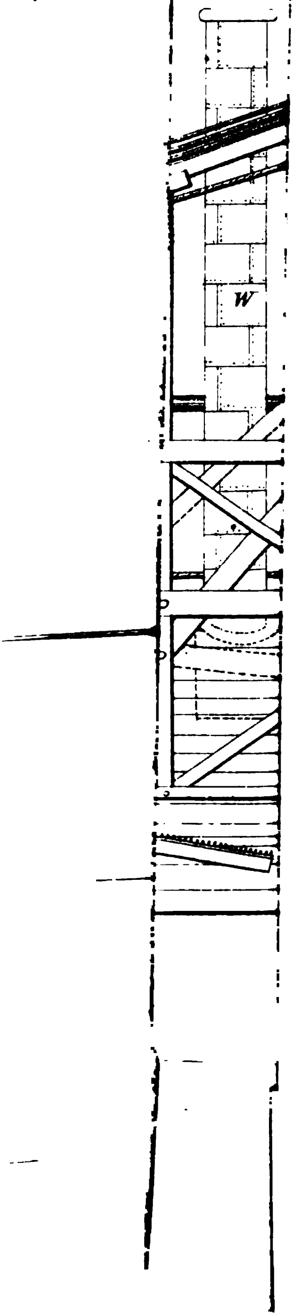

15. For an *Improved Machine for Making Paper Bags and Envelopes;* John A. Smith, Clinton, Mass., and S. E. Pettee, Foxborough, Mass.

Claim.—"1st, The bar to relieve the end of the under sheet of the weight pile, partially or wholly. 2d, The friction bar, to separate the under sheet. 3d, The guide bar, in connexion with bar to hold the sheet in place for the jaws. 4th, The lifter, to relieve the sheet from the weight of the pile. 5th, The feeding from the bottom of the pile. 6th, The combination of the weight bar, friction bar, guide bar, and lifter, constituting a feeding apparatus. 7th, The jaws to place the paper in position. 8th, The former to fold the paper over or around. 9th, The pasters and side folders. 10th, The combination of the table, the bar, the side folders, and pasters, or any other substantially the same."

16. For an *Improvement in Bench Plane Stock;* George E. Davis, Lowell, Mass.

Claim.—"The metal plane stock having a formation of a lip, in the back part of its throat, so as to fill the recess which would otherwise be below the level of the cutting irons, so as to present a continuous smooth surface to the plane, excepting the edge of the cutting irons and throat forward of them for the outward passage of the shavings."

17. For an *Improvement in Alloys for Journal Boxes;* Thomas Firth, Cincinnati, Ohio.

Claim.—"A composition of matter, of copper and zinc in the proportions of seven and one-half parts of copper to ninety-two and a half parts of zinc, or any other mixture substantially the same, and which will produce the intended effect."

18. For an *Improved Machine for Sawing off Piles under Water;* James Fleming, Portsmouth, Va.

Claim.—"The combination of a circular saw and its shaft, carried in movable arms upon and around a stationary shaft, which sustains the driving pulleys, and which is fixed to an adjustable tongs or clamp for the purpose of cutting or sawing off piles under water. Also, the method of fastening to the pile to be sawed by means of a clamp or adjustable tongs, with suitable jaws and teeth. Also, the method of feeding a circular saw from points of resistance fixed upon a stationary shaft by means of arms, curved racks, and pinions."

19. For an *Improvement in Farm Gates;* Cornelius L. Harsen and Moses R. Brailey, Norwalk, Ohio.

Claim.—"The construction of farm gates with their several parts loosely connected, combined with the bent lever and diagonal rod, arranged and operating so as to elevate the gate in opening for the passage of obstructions."

20. For an *Improvement in Gang Ploughs;* Thomas J. Hall, Tawakana Hills, Texas.

Claim.—"The arrangement of the ploughs and pivoted beams with the adjustable cross beams, so that the ploughs have a convenient permanent adjustment in connexion with their self adjusting property in the plough beam."

21. For an *Improvement in Spring Rollers for Curtains;* John and Jacob Hartshorn, Boston, Massachusetts.

Claim.—"Attaching one end of the springs to the sliding block, for the purpose of enabling them to increase and diminish in length as they are wound up and expanded."

22. For an *Improvement in Boot and Shoe Stretchers;* Warren Holden, Philadelphia, Pennsylvania.

Claim.—"Dividing the last into a number of parts connected by rods and a link, and forcing said parts outwards, so as to stretch the boot or shoe at any desired part, or at all parts, by means of the device composed of the jointed levers, nuts, and rod."

23. For an *Improvement in Boot Crimping Machines;* Hosea B. Horton, Northville, Michigan.

Claim.—"The adjustable wires (made so by set screws) on the face of the jaws."

24. For an *Improved Projectile for Fire Arms;* Eben Hoyt, Jr., Chelsea, Mass.

Claim.—"The employment of inclined surfaces upon the rear end of the ball."

25. For an *Improvement in Mitre Box;* Matthew Spear, Bowdoinham, Maine.

Claim.—"The sliding index arch, as combined with the lumber bearers or supporters and the saw guide, and made to operate therewith. Also, the combination of the extra grooves with the lumber supporters. Also, the combination of the grooves and said lumber supporters. Also, the combination of the adjustable gauge with the edge supporter, the same being to determine the length of the stuff to be operated upon. Also, the mode of constructing the head of the adjustable gauge, so that it may serve to increase the bearing for the stuff during the operation of mitreing the supplement of an angle. Also, the movable edge pieces, in combination with the lumber bearers. Also, combining with the curved arc, the inner index scale, for the purpose of enabling a person to adjust the machine for the purpose of mitreing to the supplement of any angle required. And, also, combining with the movable pieces the projecting lips."

26. For an *Improved Machine for Clamping Sash, etc.;* Solomon P. Smith, Half Moon, New York.

Claim.—"The employment or use of the clamps, operated by levers, and forming what is commonly termed a toggle joint, in combination with the adjustable heads."

27. For an *Improvement in Sewing Machines;* George W. Stedman, Vienna, N. J.

Claim.—"Feeding the cloth or other material along by means of a pin, or its equivalent, playing in a revolving shaft, which, at the proper moment in each revolution, brings it in contact with a stationary cam, or its equivalent, whereby the pin is pressed into the cloth, but again recedes therefrom as soon as freed from the cam. Also, the cam, upon a movable arm or its equivalent, so that by simply adjusting its position, the length of the stitch can be varied at the will of the operator."

28. For *Improvements in Machines for Burnishing Metals;* Jerh. Stever, Bristol, Conn.

Claim.—"The arrangement of the connecting rod of the burnishing slider, the rocker shaft, the slider, the rod, and the bow or stirrup, whereby the movement of the burnishers may not only be entirely arrested, while the rocker shaft is in motion, but may have given to it such an extent of reciprocating movement as occasion may require."

29. For an *Improvement in Furnaces for Heating Wrought Iron Wheels for Forging;* William R. Thompson, Cleveland, Ohio.

Claim.—"The arrangement of the furnace, with double fire places or chambers, furnished with flues and dampers in combination with the wind pipe and valves, for the purpose of alternately heating both sides of the hubs of wrought iron wheels or other articles, between the nozzles."

30. For an *Improvement in Projectiles;* Wilderich Jos. Von Kammerhueber, Washington City, D. C.

Claim.—"The lens shape of the projectile, made of any desirable material or combination of materials, solid or hollow, and which projectile is to be thrown by any exploding or expanding substance."

31. For an *Improvement in Arranging Shafts and Pulleys at an Angle;* Abner Whitely, Springfield, Ohio.

Claim.—"The mode of arranging the bearings, consisting of the stud or projection from the bearing of one shaft, which stud is a bearing for the pulley, gear wheel, or coupling of the other revolving part, and through which the axis having the pin passes, for the purpose of forming a secure and compact adjustment of the parts when the respective axes of motion have a fixed and invariable angle with each other."

32. For an *Improved Lubricator;* Robert M. Wade, Wadesville, Virginia.

Claim.—"Constructing the moving parts of a central sectional spindle, with disk valves at its extremities, susceptible of steam-tight adjustment, and combining the same with the perforated diaphragm of the oil reservoir, for preventing external leakage, and otherwise acting. Also, the sectional rim and spring in combination with the arrangement of the valve apertures relative to the ends of said rim, so as to furnish there stopping points to the actuating lever for feed discharge, and the entire closing of the lubricator when operating."

33. For an *Improvement in Self-Loading and Unloading Carts;* Jonathan Wilkinson, Hopewell Cotton Works P. O., Pennsylvania.

Claim.—"The combination and arrangement in one vehicle of a series of two, three, or more comparatively small scoop shovels or scrapers and their respective carrying boxes, so that each of the series can be loaded in succession, independently of the others, while the vehicle is in motion, thus, owing to the shortness from front to rear of the scoops to be forced into the substance with which the cart is to be loaded, and the smallness of the quantity to be taken up by each, avoiding the necessity of employing a powerful team, or of hitching on an extra team while the vehicle is being loaded, as is usually the case in taking up a sufficient load for an ordinary team in a cart having but one large scoop; and so that when the vehicle is removed to the place where the load is to be deposited, all the boxes of the series can be dumped or unloaded simultaneously without stopping the team, and leave the contents spread out in a layer of uniform or nearly uniform depth, or in any other manner substantially equivalent thereto. Also, the manner of operating the scoop and boxes by means of levers connected to them by two rods, or their equivalents, to each lever, the one attached to the box being connected with the lever nearer its fulcrum than the one attached to the scoop, so that operating the lever will move the scoop through a greater space than it does the box, thus enabling the scoop to be depressed a sufficient distance to take up its portion of the load, and then elevated so as to constitute the front of the carrying box, while at the same time, the box is elevated by the rod attatched to the lever nearest its fulcrum, a sufficient distance to be clear of the surface over which the vehicle is to be conveyed. Also, the manner of attaching the scoop boxes to the adjustable frame, and the adjustable frame to the fixed frame, by means of sliding bars or rods, or their mechanical equivalents, so constructed and arranged that the scoops and boxes are capable of a vertical but not of a horizontal motion, except as the whole vehicle is moved, thus enabling the scoops while being loaded, to be held firmly at any desired depth against the substance to be taken up by them."

34. For an *Improved Arrangement of Means for Regulating the Discharge of Exhaust Steam in Locomotives;* John E. Wootten, Philadelphia, Pennsylvania.

Claim.—"The arrangement of the piston within the cylinder, in combination with the steam or water space of the boiler, and with the exhaust chamber in relation to the spring, rods, and levers, and beams, and valve."

35. For an *Improvement in Machines for Polishing Leather and Morocco;* Nathan Ames, Saugus, Mass., Assignor to Samuel Green, Lynn, Mass.

Claim.—"The method of raising the figuring or polishing tool, while passing back over the table, *i. e.* by making the tool holding hand in effect a fixed part of the connecting arm, so that the machine partaking of the nature both of a reciprocal and rotary motion, may operate without joint, noise, or friction, as easily and silently as a wheel revolving on its axle, and as rapidly as may be desired, and at the same time moving in a uniform ellipsoidal orbit over the table without touching it."

36. For an *Improved Furnace for Burning Bagasse;* Elizabeth A. Stillman, Administratrix of Alfred Stillman, deceased, City of New York.

Claim.—"The furnace for employing Bagasse, without previous drying, as fuel for generating steam."

37. For a *Machine for Boring Fence Posts;* Jas. Temple, Assignor to Israel Ward and James Temple, Birmingham, Pennsylvania.

Claim.—"The supporting of the long pinion and the auger shanks in the adjustable hinged pillar blocks, so that the augers may be set to bore holes at variable distances apart, whilst the spur wheels on their shanks shall still keep in gear with the long pinion."

38. For a *Machine for Sawing Fire Wood, &c.;* Elias A. Tubbs, Hampton, N. H., Assignor to E. A. Tubbs, and H. T. Croxon, Dorchester, N. H.

Claim.—"1st, The method of bringing the saw into operation by the pressure of the log upon the stop. 2d, The method of causing the weight of the saw, after it has passed through the log, to bring into operation the mechanism which raises it out of the way preparatory to making another feed. 3d, The method of operating the clamp, by means of the spring bar, whereby the clamp is rendered capable of holding logs of varying thicknesses, without constant readjustment. 4th, The device for the purpose of stopping and starting the feed at the required moment, consist essentially of the combination of the shaft, the lever, the wheel, and the shipping finger."

MAY 8.

39. For an *Improvement in Tape Fuze;* Philip Bacon, Sinsbury, Conn.

Claim.—"The application to tape fuze of an external winding of thread, whereby the loosening or cracking off of the tape and water proofing substance is effectually prevented, and the manufacture of the fuze cheapened and simplified."

40. For an *Improvement in Seed Planters;* George W. Brown, Galesburg, Illinois.

Claim.—"In combination with the hoppers, and their semi-rotating plates, the runners, with their valves, and their adjustment by means of the levers and cams, and the driver's weight, for the purpose of carrying and dropping seeds by each vibration of the lever, and to regulate the depth of the planting."

41. For an *Improvement in Preparing Turpentine for Distillation;* Alex. C. Blount, Mount Pleasant, Alabama.

Claim.—"Freeing the crude turpentine of chips, bark, straw, and other impurities and coloring matters before introducing it to the still, by melting it in a cylinder or vessel which contains one or more sieves, and is arranged in such manner that the melted turpentine may run from it to the still by gravitation."

42. For an *Improvement in Stone and Marble Saws;* J. T. Bruen, City of New York.

Claim.—"Making the body of the saw plate of woven wire or strips of metal, or any analogous device, for the purpose of admitting the free passage of the grit, in the operation of sawing stone. Also, in combination with the above, the waved cutting edge or any analogous device. Also, forming the edges of the saw blade thicker than the central portion, so as to admit of the free passage of the grit on both sides, through the indentations."

43. For an *Improvement in Lamps for Burning Fluid;* Dexter H. Chamberlain, West Roxbury, Massachusetts.

Claim.—"The employment of granulated pomice stone as a packing for spirit lamps and other vessels containing any inflammable hydro-carbon."

44. For an *Improvement in Machines for Making Bolts;* Robert Critchton, Buchanan, Pennsylvania."

Claim.—"The combination of the adjustable shaft, the detached shaft, the spring and stop, with the sash, and horizontal heading tool, to regulate the quantity of iron in and thickness of head."

45. For *Improvements in Boot Crimps;* Thomas Dougherty, Erie, Pennsylvania."

Claim.—"1st, The projections, to which the leather may be tacked after it is stretched, thereby permitting the stretching apparatus to be removed and applied to another crimping board." 2d, The nut, with projections fitting upon both sides of the elbow."

46. For an *Improved Faucet;* William Fowler, City of New York.

Claim.—"Having the lower end of the tube fitted within a valve seat, which seat is screwed into the upper part of a socket, at the upper part of the main pipe or tube, and adjusting the lower end of the tube snugly within the valve seat, by means of the nut, the tube turning within the seat; the seat and tube being provided with openings, which when made to coincide with each other by turning the nozzle and tube, allow the water to pass up through the nozzle."

47. For an *Improvement in Railroad Car Ventilators;* D. H. Fox and John Fink, Reading, Pennsylvania.

Claim.—"The construction in or on the top of the car of a long shallow chamber communicating at several points with the interior of the car, and by a tube with a fan chamber beneath the car, whereby the partial exhaust created in said chamber by the running of the car, produce a number of upward currents simultaneously in various parts of the car, sufficient to carry off the vitiated air and dust from the same."

48. For an *Improvement in Dissolving Silica;* Benj. Hardinge, City of New York.

Claim.—"Filling the pipe with the water from the upper stratum in boiler so constructed as to find its common level in pipe, in furnace, from whence the heated steam is forced over and down into the under stratum of the heavy silicates by the horn-pipe, while the steam pressure is relieved from the surface by my relief pipe, which coils through the tank of cold water."

49. For an *Improvement in Facing Beds for Grinding Artificial Granite, &c.;* Benj. Hardinge, City of New York.

Claim.—"The artificial grind-stone or facing bed, consisting of a saucer-shaped dish filled with a concrete of the materials specified, or other substantially the same. Also, the suspension of the shaft which carries the rotary facing bed upon steel supporters."

50. For an *Improved Machine for Sawing or Felling Trees;* Simon Ingersoll, Greenwich, Connecticut.

Claim.—"Giving to the segmental saw its reciprocating action during the forward feed of the same by means of the pitman, connected by link rod, K, to the saw frame, and by joint or link rod, T, to the side carrying the saw, or saw frame, and giving feed thereto."

51. For an *Improved Mode of Checking Wind-Mills;* A. Lempeke, Pleasant Mount, Pennsylvania.

Claim.—"Operating the sleeve or collar, or moving said sleeve or collar on the shaft, towards the wings or sails, by means of the screw on the shaft rod, attached to the sleeve or collar and lever, whereby the chains are slackened and the wings or sails are allowed to turn edgewise to the wind, and consequently stopping the mill."

52. For an *Improved Propeller;* Henry Link, Little Falls, New York.

Claim.—"A semi-circular propeller, whether the same is used with or without hinged paddles."

53. For an *Improvement in Grain Harvesters;* T. N. Lupton, Winchester Virginia.

Claim.—"The employment or use of the cutters, placed on the rotating shaft, in combination with the two sets of fingers."

54. For an *Improvement in Grain and Grass Harvesters;* John H. Manny, Rockford, Illinois.

Claim.—"The combination of a removable auxiliary divider with a fixed divider."

55. For an *Improvement in Guides for Hemming and Cording;* Henry B. Odiorne, Philadelphia, Pennsylvania.

Claim.—"The curved retainer, with its notched end, in combination with the shoe, for effectually keeping the cord in contact with the inside of the hem of the fabric, while the said hem is being operated upon by the needle and thread of a sewing machine."

56. For an *Improvement in Ventilating Railroad Cars;* W. Pauli, Alexandria, Va.

Claim.—"The arrangement of guard sash, on the sides of the cars, in connexion with descending tubes and hood upon the top thereof, by which the dust is prevented from entering a window when opened, while the exit of the air and ventilation of the car is not affected by said guard sash."

57. For an *Improvement in Window Sashes;* Lyman E. Payne, Yazoo City, Miss.

Claim.—"Having strips attached to the inner sides of the frame casing, the outer edges of the strips being inclined or beveled, and fitted within rebates, in the inner surfaces of the stiles of the sashes, the shoulders of said rebates being inclined or beveled, so as to correspond inversely with the edges of the strips."

58. For an *Improvement in Spark Arresters;* Gilbert Richards, Cummington, Mass.

Claim.—"The spiral flanch and deflecting plates."

59. For an *Improved Balance-Gate Faucet;* Ezra Ripley, Troy, New York.

Claim.—"The combination of the duplicate discharge gates of the faucet tube with the duplicate discharge cut-off gates; the two parts being combined for the purpose of forming a balance discharge and cut-off gate, for faucets or fluid gates."

60. For an *Improved Nozzle for Hose-Pipes;* Albert W. Roberts, Hartford, Conn.

Claim.—"The combination of two or more movable nozzles or tips of different sizes attached to one pipe, which can be moved by the pipe holder or his assistant, to change the size of the stream when in motion, for fire engines or for other purposes."

61. For an *Improved Machine for Leathering Tacks;* M. M. Rhodes and J. C. Rhodes, Taunton, Massachusetts.

Claim.—"1st, The employment of a hollow cylinder with an opening in the side to receive the tacks, and a driver working within it in a suitable manner to expel the tacks at the end of the cylinder, and drive them into the leather or any material serving the same purpose which is presented in a suitable manner to receive them. 2d, Operating the cylinder and driver, so that the former may receive a short, and the latter a long movement, and that the final operation of the former to cut the leather or other material on the punch may not take place till after the termination of the operation of the latter in driving the tack through the said leather or material, but may be produced by a continued movement of the latter after it has driven the tack through. 3d, The divider, consisting of one or more tongues, having a straight edge working nearly close to and across the entrance of the receptacle into which the tacks are fed to be submitted to the operation of the driver, and having a beveled end terminating in a point to separate the tacks one by one, as they are brought by the feeder contiguous to the aforesaid receptacle, and to conduct and push them as required into the said receptacle. 4th, Forming the mouth of the barrel with a projecting lip, for the purpose of passing outside the point of the tack as the barrel rises, and the tack is entering the mouth, and thereby preventing the point from going down the outside of the barrel, and letting the tack fall head foremost into the barrel."

62. For an *Improvement in Sash Supporters;* Charles R. Rode, City of New York.

Claim.—"Having a longitudinal shaft or rod inserted in the lower cross piece of the sash, a pawl being attached to each end of the shaft or rod, said pawls catching into racks attached to the back sides of the grooves in which the sash is fitted, the shaft or rod being provided with a thumb piece which projects through a mortise or slot in the cross piece of the sash, and directly over a plate attached to said cross piece."

63. For an *Improvement in Processes for Preparing Liquids for Aiding Digestion;* Josiah J. Sherman, Albany, New York.

"My improvement consists in changing the condition of the alimentary or other digestible matter contained in malt liquor beverages by infusing a solution."

Claim.—"New Composition."

64. For an *Improvement in Apparatus for Regulating Supply of Water to Steam Boilers;* Thomas J. Sloan, City of New York.

Claim.—"The employment of the feed water before it enters the boiler, as a motor for giving the alarm when the water is too low in a steam boiler or generator, in combination with the float inside the boiler for indicating the level of water, and setting the mechanism that the alarm may be operated by the mechanism receiving motion from the feed water. Also, stopping the supply of water to the boiler by the employment of a stop to check the working of the valve, but this only when the said stop is simply set by the float within the boiler."

65. For an *Improvement in Fire Arms;* John Stowell, Charlestown, Mass.

Claim.—"The method of effecting the connexion between the hammer and the lever, D, by which the sliding crotch is operated by means of a lever, *d*, and two stirrups."

66. For an *Improved Machine for Rolling Railroad Rails;* A. J. Suffern, Suffern, N. Y

Claim.—"The employment of three rollers in combination, arranged with their axes in the lines of an equilateral triangle, each roller having a projecting fillet, and a groove each side, and the three working in unison, for rolling three tread rails, each roller forming the surface from the middle of one tread to the middle of the next, and the groove between of such form that each head or tread may be wider than the thickness of the shank."

67. For an *Improvement in Ploughs;* E. C. Tavenner and Oscar Nesmith, Hamilton, Va.

Claim.—"The land-side plate, in combination with the fend-off cleaner."

68. For an *Improvement in Smut Machines;* Grant B. Turner, Cuyahoga Falls, Ohio.

"The nature of my invention consists, first, in interposing between the runners and outer concentrators of the machine, a perforated flanch, which I term a partial concentrator, for separating and removing the smut without allowing it to commingle with grain after it is once loosened from it. Also, in the method of escaping the white caps and other lighter material from the screen in the wind trunk."

Claim.—"In combination with the scouring disk or runner, and outside concentrator, the inner perforated and partial concentrator, slightly elevated from the outer one. Also, in combination with the screen in the blast trunk, the opening directly under said screen, to allow the white caps which may have passed through the scouring plates to pass out, instead of being held up against the bottom of said screen by the blast."

69. For an *Improvement in Silvering Looking-Glasses;* Joel Webster, Brooklyn, N. Y.

"This invention is for silvering common glass, which by reason of unevenness of surface will not bear pressure upon a hard flat table."

Claim.—"1st, The two tables having elastic faces and being employed in combination with each other. 2d, When the requisite elasticity is given to the faces of the tables, by the employment of an air packing, connecting the air cavities, by means of a flexible tube, by which means both cavities are caused to be filled with air at once and to contain an uniform pressure."

70. For an *Improved Inkstand;* Henry Whitney, Jr., Cambridge, Massachusetts.

Claim.—"The well and the cylinders, in combination with the piston and the cylinders, for the purpose of raising and sustaining the ink above its level in the inkstand without the necessity of using the tight packed joint heretofore required."

71. For an *Improved Shingle Machine;* Andrew P. Wilson, Piqua, Ohio.

Claim.—"Mode of adjusting the block out of which the shingles are to be cut, by means of the adjusting slats underneath the doors, and also the springs for supporting the shingle; also the cleaners, for the purpose of cleaning the shingle from between the knife and springs, and for the purpose of keeping the doors clean from all substances that may fall on them."

72. For an *Improved Method of Sawing a Log by its own Weight;* Francis A. Wolff, Ripley, Mississippi.

Claim.—"The method of making the weight of a log or logs of timber propel the saws which saw them, by suspending them on endless chains, working around chain wheels, which drive the saws."

73. For an *Improvement in Gas Regulators;* G. B. Woodruff and James N. Palmer, New Haven, Connecticut.

Claim.—"1st, The employment of adjustable escape tubes or passages, at the upper part of the air chamber, in connexion with valves attached to a float which rises and falls with the water in the air chamber, the said valves acting to close the said tubes or passages to confine the air in the air chamber when the water or other liquid reaches a certain level therein, and thus prevent the water being in the gas chamber pressed down below the regulating float. 2d, The employment of two induction valves, arranged and connected by a spring, in such manner that when the pressure of gas in the gas chamber increases to such a degree, that the action of the float would close both of the said valves, and entirely shut off the gas, the said spring will yield to the pressure of the gas upon the under side or front of one of the valves, and allow that valve to remain open until the pressure in the gas chamber is reduced, and the level of the liquid therein is restored sufficiently to open the other valve."

74. For an *Improvement in Plating and Twisting Cord;* William H. Zahn, Assignor to F. Renter, City of New York.

Claim.—"The arrangement for driving the flyers, consisting of the circular rack, gearing with the spur wheels, said rack being on a table, which has a central pivot, through which the spindle of the flyer frame passes, whereby the flyers are set in operation, whether the flyer frame or the table revolves, and are enabled to receive merely a rotary movement on their own axes for making twist, or such rotary movement combined with a revolution round a common axis for making cord."

75. For an *Improvement in Apparatus for Manufacturing Starch;* Hendrick V. Duryea, Oswego, New York, Assignor to Oswego River Starch Company.

Claim.—"The construction and adaptation of the rake, furnished with teeth, and hung on chains, for digging, cutting up, and loosening starch deposits."

76. For an *Improvement in Artificial Fuel;* Thomas Hoooker and Wm. D. Beaumont, Assignors to A. A. Pray, N. M. Harris, E. C. Lemoyne, J. R. Jennings, G. G. Kirk, and L. A Kirk, New Orleans, La.

Claim.—"The manufacture of a new article of fuel, composed of lime, fine coal, clinkers, rosin, carbonate of ammonia, and bagasse, or their equivalents, mixed in the proportions (one hundred and forty parts of any of the known formations of earth; thirty parts of common lime; twenty parts of the dust or refuse of coal; two parts of clinkers or iron dust; three parts of common rosin or pitch; two parts of carbonate of ammonia; eight parts of saw dust or chips.")

77. For an *Improved Machine for Sawing Wedges or Shingles;* J. Taggart, Roxbury, Mass., Assignor to self and Nehemiah Hunt, Boston, Mass.

Claim.—"The peculiar combination of mechanism employed for moving the bolt forward, and changing its position, so that a shingle or wedge shall be removed from it by the saw during each longitudinal movement of the bolt produced by the main carriage, the said combination consisting of the carriage, the turning bearer, its lifting catches, the notched racks, the two levers, the stationary lifters, and the stationary rails, the whole being combined with the main reciprocating carriage and the frame of the machine, and made to operate together and with the circular saw."

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78. For an *Improvement in Circular Metallic Plate Springs;* John W. Adams, City of New York.

Claim.—"The combination and arrangement of one or more flat circular steel plates held in place by a central pin, and allowed to spring a limited space between solid convex and concave metallic plates."

79. For an *Improvement in Sleighs;* David S. Barber, Almon Thompson, and De Algeroy Thompson, Pittsfield, Vermont.

"The nature of this invention consists in providing the running gear of any common sleigh or sled with four wheels, on which the sleigh may instantly be made to run, which is done by means of two crank or angle shaped axles operated by a connecting rod and lever, so that the wheels may be thrown below the runners of the sleigh so as to run on the ground, or may be thrown or raised up so that the sleigh will run on its runners: thus it may be made to operate either as a sleigh or wagon."

Claim.—"The attachment of wheels to a sleigh."

80. For an *Improved Ventilating and Cooling Apparatus;* Job R. Barry, Philadelphia, Pennsylvania.

Claim.—"The arrangement of a fan and one or more refrigerating wheels, or their equivalent, with the water tanks, ice reservoir, and return air flue, for securing effectual ventilation and cooling the air."

81. For an *Improvement in Rosin Stills;* Francis Bowman, Somerville, Mass.

Claim.—"The arrangement of section G, of the still by inserting the metallic tube, and section of a tube covered with glass inside and outside, or a similar tube not covered with glass, projecting at any distance from the inside towards the centre of section G. Also, the suspension of the inverted bowl covered with glass inside and outside. I also claim the formation of an arch under the still, constructed of fire brick, soap stone, or any other substance, to prevent the fire from touching the bottom of the still."

82. For an *Improvement in Double Acting Spring Hinges;* Henry E. Canfield, City of New York.

Claim.—"The attachment to one pin of two flat coiled springs, coiled in opposite directions, in combination with the holder, or its equivalent."

83. For an *Improvement in Window Sash Fixtures;* Handel S. Chaplin, Glover, Vt.

Claim.—"Arranging two spring friction bolts, their retractive arms, cams, and one rocker shaft together, and with respect to two window sashes."

84. For an *Improvement in Connecting Clamps for the Plates of Galvanic Batteries;* Charles T. Chester, City of New York.

Claim.—"The arrangement for fastening and connecting the battery plates, viz:

Clamps of brass or such other metal as will alike answer the purpose of the arrangement attached to the insulating bar of wood commonly used in Simes' Battery in such manner, that the battery plates clamped to them shall be separate from the wooden bar, and the solution be prevented from finding its way by capillary attraction to the wood, and which shall, by their form, allow of an easy removal and replacement of each separate plate without the disturbance of any other part of the battery arrangement."

85. For an *Improvement in Sewing Machines;* John Chilcott and James Scrimgeour, Brooklyn, New York.

Claim.—"The arrangement of the revolving disk within or on the fixed table, and having its axis in line with the needle, when combined to operate together with a roller bearing on the opposite side of the cloth, and made adjustable to any position in a circle round the centre of the said disk, to vary with facility and despatch the run of the seam in lines on any side of the needle without the aid of guides on the face of the table, and whether the revolving disk or bearing roller be caused to move the cloth."

86. For a *Machine for Splitting Wood;* Jacob A. Conover, City of New York.

Claim.—"The movable bed or carriage for carrying and advancing the blocks of wood, in combination with the reciprocating cutters operating at right angles with the surface of the bed or carriage. Also, in combination with the bed or carriage and reciprocating cutter, the employment of the clearing plate through which the cutters pass. And finally, I claim providing the said clearing plate with an elastic pad, and imparting to it an up and down motion, in its combination with the bed or carriage and reciprocating cutter, by means of which the said plate, under the combination, performs the double office of holding the blocks and clearing the cutters."

87. For an *Improvement in Cording Guides for Sewing Machines;* Henry W. Dickinson, Hartford, Connecticut.

Claim.—"1st, A holder or presser to a sewing machine formed with a groove to hold a cord in its place while being stitched into cloth or other material for the purpose of forming a corded seam. 2d, Forming the face or bearing side of an adjustable guide with grooves, so arranged as to receive and act upon a finished corded seam, and guide the cloth parallel while stitching another seam or sewing in another cord."

88. For a *Veloci-trat Lubricator;* George Dixon, Lafayette, Indiana.

Claim.—"Providing oil cups of crank pins and other movable journals with a valve."

89. For an *Improved Mowing Machine;* Ezra Fahrney, Mount Morris, Illinois.

Claim.—"The employment of the two self-adjusting slides, with the two cams, arranged a short distance apart on a wheel having a slower motion than the beater shaft."

90. For a *Gauge for Slitting Lumber;* Francis P. Hart, Chandlersville, Pa.

Claim.—"1st, The employment of a rotary cutter secured to the shaft of the gauge when the said shaft screws into the stock, and is made capable of turning freely therein, for the purpose of gauging taper work. 2d, Attaching the adjustable scriber by a hinged joint constructed with a shoulder, to the slider which carries it, so that it may be rigid when extended for mortising, but may fold into the recess in which the said slider works when the gauge is used for other purposes than mortising. 3d, The employment of a round faced guide piece, fitted to slide within the stock of the gauge, so as to be withdrawn into it when the gauge is to be used for straight work, but to be protruded from it when required to serve as a guide for gauging curved, circular, or irregular work."

91. For a *Mitre and Beveling Machine;* Lorton Holliday, Rogersville, N. Y.

Claim.—"The manner of arranging and combining the several parts constituting the mitre box; whereby the saw guide is rendered capable of being adjusted in the path of a horizontal circle as well as in the path of a vertical circle to any angle desired, and enables the saw to cut a bevel lap on the strip or board simultaneously with the sawing of the mitre or angle, and also indicates the angle cut."

92. For an *Improvement in Condensers for Fibrous Materials;* William H. Howard, Philadelphia, Pennsylvania.

Claim.—"The combination of the several parts for conducting and condensing the fibrous material from the doffer of a carding engine to the spool, to wit, the two sectional rolls working in contact with each other, and the upper one in contact with the doffer for doffing and conducting the sliver from the doffer. Also, the two series of convex disks mounted upon shafts in front of and parallel to the said rolls, with the guide plate to govern the position of the slivers between the said disks for twisting and condensing the slivers as they are conducted from the doffer to the spool. Also, the manner of constructing the upper parts of the guides of the journals of the spool, to wit, making the outside portion thereof form parts of levers, whose operation is controlled by a bar or weight and a catch."

93. For an *Improved Adjustable Tenoning Tool;* Thos. J. Knapp, Philadelphia, Pa.

Claim.—"The construction of the tool, viz: having two segments of a cylinder secured to the flanch of the shank by screws, and having screws pass through the flanches and projections of both segments, for the purpose of allowing the segments to be placed nearer together or further apart, as desired, and having a hub or boss at the centre of the face of the flanch to receive the rings of different sizes corresponding to the diameter of the tenons to be cut, and by which rings the segments are properly adjusted the required distance apart for the purpose of cutting tenons of various sizes."

94. For an *Improvement in Spark Arresters;* David Matthew, Philadelphia, Pa.

Claim.—"The annular space between the base of the smoke pipe and the section extending down into the smoke box, with the exhaust pipes underneath."

95. For an *Improvement in Curtain Fixtures;* Perches Miles, Hartford, Conn.

Claim.—"The combination of the cords with the tassel and cam lever, the whole being arranged and operating for the purpose of making a simple, neat, and effective curtain fixture."

96. For an *Improvement in Cotton Seed Planters;* A. H. Morrel, Marlin, Texas.

Claim.—"The combination of sliding bar, cover, cam, and eccentric shaft, or their equivalents."

97. For a *Mode of Securing Brace Bits in their Sockets;* Ebenezer W. Nichols, Worcester, Massachusetts.

Claim.—"The burr nut (or its equivalent) in combination with the spring, operating upon the wedge principle, (by the use of the screw) the projections."

98. For an *Improvement in Joint Bodied Carriages;* A. H. Niles, Georgetown, N. Y.

Claim.—"The application to joint bodied buggy wagons, and light carriages, of the additional joint and spring or any other which will produce the intended effect."

99. For an *Improved Method of Regulating Wind Mills;* Fras. Peabody, Salem, Mass.

Claim.—"Regulating the action of the wind upon the wheel by means of the disk."

100. For an *Improved Mode of Attaching Hubs to Axles;* John M. Perkins, City of New York.

Claim.—"Attaching the hubs to axles by having segment projections attached to the back end of the hub and lips on the inner surface of a cap which is placed loosely on the arm of the axle, said lips being fitted over the projections by turning the cap, and prevented from moving off the projections upon the backward movement of the wheel or vehicle by the pin."

101. For an *Improvement in Window Shutters;* George W. Phipps, Philadelphia, Pa.

Claim.—"The peculiar form of the side grooves in the frame tapering from the bottom to the top, increasing with the additional thickness given by the shutters in being lifted. Also, the supporting top bar and its grooves, and the vertical side bars. Also, the combination or arrangement of the upper bar, the vertical bars, and the slats to produce the effect alleged."

102. For an *Improvement in Steam Engine Valves;* John A. Reed, City of New York.

Claim.—"Beveling the edges of the cylindrical valve, or its equivalent, and beveling the edges of the steam ports, whereby I am enabled to move the valves within the ports; the beveled edges of the ports thus being valve seats, and the beveled edges of the valves being faces to fit thereto."

103. For an *Improved Slide Lathe;* E. K. Root, Hartford, Connecticut.

Claim.—"Giving to the tool-post slide a motion towards or from the line of the axis of

the mandrel, in combination with the longitudinal feed motion of the carriage, and derived **therefrom or** bearing a certain relation thereto."

104. For a *Hot Air Furnace;* S. J. Russell, Chicago, Illinois.

Claim.—"The employment of the vertical trunks, horizontal pipes, and horizontal **plates connected** with the fire chamber and enclosed by a casing."

105. For an *Improvement in Butter Coolers;* James H. Stimpson, Baltimore, Md.

Claim.—"The double wall cover and reservoir with a diaphragm or shelf between **them. Also,** making the support for the butter knife upon the cover or handle, one or **both, so that** the knife cannot be put in place without closing the lid, thereby securing **the economy** of ice and the hardness of butter."

106. For an *Improved Machine for Polishing the Soles of Boots and Shoes;* John H. **Thompson,** James M. Thompson, and H. Q. Thompson, Holderness, N. H.

Claim.—"A machine having a polisher or polishers made of bone or other proper material **attached** to a shaft which has a reciprocating motion imparted to it in any desirable **manner.**"

107. For an *Improvement in Machines for Creasing the Edges of Leather Straps;* **Wm.** McK. Thornton, Pottsville, Pennsylvania.

Claim.—"The movable collars of different sizes on shaft F, in combination with the **movable metallic** creasers on shaft H, having flanches extending below the periphery of **the collars** and shoulders with grooves."

108. For an *Improvement in Temples for Looms;* Jeremiah C. Tilton, Sanbornton **Bridge,** N. H.

Claim.—"The combination of the serrated spring hook and the spring cloth bender."

109. For a *Device for Adjusting Planing Machinery;* Leonard Tilton, City of N. Y.

Claim.—"1st, Hanging the axis or journals of the upper feed rollers in suspended **bearings** attached to the rods. 2d, Adjusting the cutting cylinder by having its bearings **attached** to vertical slide rods operated by the bevel wheels and screws, and securing **the cylinder** at the desired height by means of the clamps and rod. 3d, The employment **or use** of the guide rod and guide, arranged for the purpose of keeping the adjustable **cutter** firm and steady while operating, and causing it to be adjusted with facility."

110. For an *Improvement in Spring Curtain Rollers;* Benj. B. Webster, Boston, Mass.

Claim.—"In combination with spring *a* the friction spring *c* or its equivalent, combined **with** and operated by a cord so as to stop the rolling up of the curtain, or to cause the same to roll, or to hold the same at any point required."

111. For an *Improved Composition for Filling in Fire Proof Safes;* David Weiser, Milwaukie, Wisconsin.

Claim.—"The employment and use of the composition of matter, as a fire proof filling or lining for fire-proof safes, or other rooms, compartments, or places, required to be made fire-proof."

112. For an *Improved Furnace Grate Bar;* Robert Wicks, City of New York.

Claim.—"The construction of the grate bars of furnaces with dove tails, or other analogous interlockments, so as to connect the bars together, keep them from twisting out of place or sliding from the bearing bars, while affording the greatest facility in removing defective and inserting new bars."

113. For a *Machine for Cutting Irregular Forms;* J. S. Barber, Boston, Massachusetts, Assignor to Robert J. Marcher, Blooming Grove, New York.

Claim.—"The machine for turning ovals, consisting essentially of the sliding cutters in combination with the table and pattern."

114. For an *Improvement in Dressing Sewing Thread;* John M. Heck, Assignor to Henry Terry, Plymouth, Connecticut.

Claim.—"The using (or in other words, subjecting the thread to the use, action, and friction) of a series of rapidly revolving brushes, to polish, soften, and dry the thread after having sufficiently saturated with a size or liquid, whereby smoothness, lustre, pliability and strength is imparted to the thread."

115. For a *Mode of Indicating the Numbers of the Yea and Nay Balls in Machines for taking Votes in Legislative Bodies;* Samuel Huffman, Assignor to self and C. D. Hay, Charleston, Illinois.

Claim.—"The use of transparent tubes, or their equivalents, provided with index scales, for the purpose of showing the number of votes on either side of a question by indicating the number of balls which have passed into each tube."

116. For a *Fluid Metre;* John Taggart, Assignor to John Taggart and Julius S. Shailer, Roxbury, Mass.

Claim.—"1st, Two chambers united by a rectangular or square neck or passage made of a width greater than the thickness of the vibrating piston or plate extended through the neck. 2d, An induction pipe or opening in the upper chamber. 3d, Two eduction passages and valves applied to the lower chamber. 4th, A vibrating plate dasher or piston extending from one chamber into another chamber. 5th, A mechanism applied to the eduction valves, whereby they may be alternately opened and closed by the vibrating plate or dasher during its movement."

117. For an *Improvement in Grain Harvesters;* Benj. S. Nicholson, Administrator to the Estate of Jno. F. Nicholson, deceased, Davidsonville, Md.,

Claim.—"Making the space, through which the grain passes, in the form of a rhombus, for the purpose of depositing the grain in a line out of the track of the horse."

118. For an *Improvement in Machinery for Spinning;* Arad Woodworth, 3d, Boston, Massachusetts.

Claim.—"The use of one or more inner flyers arranged in a sequence, one within the other, to revolve in the same or different directions, or at the same or different speeds with the outer flyer, all the flyers acting continuously upon the roving yarns or material first received by the outer flyer, until the spinning or twist is completed and the yarn or yarns are wound upon the spool or bobbin, thereby twisting and spinning more rapidly and attaining any desired degree of twist in yarns."

119. For an *Improvement in Springs for Carriages;* M. G. Hubbard, City of N. Y.

Claim.—"Forming the fulcrum of the springs, by connecting them by a clip and bolt at their crossing point."

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120. For an *Improvement in Wooden Saddle Trees;* Geo. B. Ambler, Trumbull, Conn.

Claim.—"Providing the slot in the centre of the head of a wooden saddle tree and the screw thread in the top strap, said slot serving to receive the end of the gullet hook and the screw thread serving to firmly hold the screw."

121. For an *Improved Rat Trap;* Lucius B. Bradley, Watertown, Conn.

Claim.—"The employment of a swinging plate and balancing or counteracting spring, in combination with the ordinary spring, drop, or fall."

122. For an *Improvement in Steam Boilers;* Thos. G. Boone, Brooklyn, New York.

Claim.—"The arrangement of the vertical water tubes, fire surfaces, upper and lower water spaces, and non-conducting lining for giving circulation."

123. For an *Improvement in Cotton Gins;* Leonard Campbell, Columbus, Miss.

Claim.—"1st, The combination of the two bush cylinders and brush bar. 2d, The employment or use of the mote board, when constructed of two planes, placed at such angles, or in such a relative position to each other, as shown."

124. For an *Improvement in Seed Planters;* L. W. Colver, Louisville, Kentucky.

Claim.—"Hinging the pieces which support the wheels at the point, B, this being also the point of attachment of the arm, and interposing between the pieces and the arm, a spring, so that said two pieces may radiate from nearly the same centres; said spring tending to hold the wheels into the ground, whilst each one of the series may yield to any irregularities in the ground without affecting the others. Also, the arrangement of the sword or divider, described upon the tube, and projecting it forward in close contact with the flanch on the wheel, so that it may enter the ground with said flanch, and spread and hold upon the furrow for the reception of the seed."

125. For an *Improvement in the Stop Motion of Knitting Machines;* Robt. Cushman, Pawtucket, R. I.

Claim.—"The finger, placed in contact with and resting against the fabric, so arranged that when the fabric is too imperfect to support the finger, it will vibrate and stop the machine. Also, the lever, actuated by the levers and in combination with the rock shaft and the friction clutch, when so arranged and operated that the instant the thread or one of the threads break, the machine is arrested."

126. For an *Improvement in Carriage Wheels;* D. W. Clark and S. H. Gray, Bridgeport, Connecticut.

Claim.—"Having the felloes constructed of malleable cast iron, and having the spokes fitted in mortises in the hub, and in sockets on the inner surfaces of the felloes. Also, the spokes having sockets secured on them at about their centres, in which the inner ends of short oblique spokes are fitted, the outer ends of said spokes being fitted within oblique sockets on the inner surfaces of the felloes."

127. For an *Improvement in Brick Presses;* John Chase, Jr. Pequonock, Conn.

Claim.—"The swinging frame constructed, arranged, and operated for the purpose of feeding the empty moulds to the press boxes and discharging the filled moulds therefrom. Also, the employment or use of the levers or pendents, constructed with projections and placed between the bars of the grates, so that as the filled moulds are forced downward from between the grates and friction rollers, the stones, should any be in the moulds, will act against said projections and turn the pendents, so that a passage or opening is allowed for the stones to drop through."

128. For an *Improvement in Wristbands of Shirts;* Rufus K. Chandler, Richmond, Va.

Claim.—"Making wristbands with double flaps."

129. For a *Stave Machine;* Daniel Drawbaugh, Eberly's Mills, Pennsylvania.

Claim.—"The combination and arrangement of the following parts, to wit: Making the frame to vibrate on the shaft, and hinging it (the frame) to the bed, so as to operate it with a vibrating motion on the pivots and slides with the brace, which renders the bed rigid to traverse parallel so as to cut the lumber either curved or straight as required for staves, heading, or other purposes, the bar being changed or reversed."

130. For an *Improved Warm Air Furnace;* Michael B. Dyott, Philadelphia, Pa.

Claim.—"The arrangement of devices, to wit: the movable fire pot, the air flue and chamber or fire space."

131. For an *Improvement in Sewing Machines;* Chas. A. Durgin, City of New York.

Claim.—"The vibrating hook, for holding down the thread during the partial passage of the shuttle through the loop."

132. For an *Improvement in Umbrellas;* Wright Duryea, City of New York.

Claim.—"Connecting the stretchers to the outer or traversing portions or parts of the ribs, so as to hold the said portions out in their proper positions when the umbrella is spread; and also, that those portions of the ribs to which the stretchers are connected may be traversed by moving the stretchers and slide when the umbrella is closed."

133. For *Improvements in Valve Gear for Oscillating Engines;* Marcus D. DuBois, Newburg, N. Y.

Claim.—"1st, Furnishing the rock shaft by which motion is to be given to the valve or valves with three arms, c, f, f', arranged so that the arm will be brought by the oscillation of the cylinder into contact with a fixed stud, and thereby be caused to give a movement to the valve to open the ports, and that the arms will alternately be brought by the same means into contact with fixed spring catches for the purpose of giving the valve a movement to close the ports. 2d, Furnishing the rock shaft with two arms, d, d', arranged to strike two fixed pieces when necessary to throw the arms f. f', into a position to be caught by the spring catches, for the purpose of moving the valve to close the ports."

134. For a *Machine for Cutting Screws on Bedstead Rails;* Henry Gross, Tiffin, Ohio.

Claim.—"The mechanical combination and arrangement of the double V cutter and the manner it is secured in the cylinder head when used by the screw head. Also, the changes from right to left, by which changes, right and left handed screws are cut with the same cylinder head and double V cutter. Also, the mechanical arrangement and combination of the lever, the wedge and nut blocks, when working together, viz: the blocks being right and left longitudinal sections of female screws, and used to direct the course of the shaft to which the cylinder head is attached, the wedge, by which the nut blocks are changed, and the lever, which guides the blocks and keeps them in their proper place when the change is made. Also, in combination, as above, the double clamp and nut, the screw by which the clamp is opened and closed, and the rest block, for supporting the rail while being cut."

135. For an *Improvement in Fire Arms;* Henry Gross, Tiffin, Ohio.

Claim.—"The combination and arrangement of the cap cylinder with the cylindrical roller."

136. For an *Improvement in Grain Harvesters;* Jonathan Haines, Pekin, Ill.

Claim.—"So hinging the platform to the finger bar and frame as to facilitate the raking, break down the stubble, and leave the gavels in better condition to be gathered by the binders."

137. For an *Improvement in Hullers of Buckwheat;* Chs. B. Horton, Elmira, N. Y.

Claim.—"The arrangement and combination of the fan, with the suction spout, the discharge openings, and the stones."

138. For a *Tree Nail Machine;* J. W. Hoagland, Jersey City, N. J.

Claim.—"1st, The use and employment of the circular plate with its diagonal slots to concentrate or expand the cutters and thus regulate the size of the tree nail. 2d, The use and employment of the followers with its apparatus of band and wheel to govern the gauge, so that the tree nails may be made uniform in size. 3d, The use of the levers and their apparatus of ovals to separate the feed rollers or allow them to approach each other for the purpose of holding the tree nail firmly while it is being enlarged or diminished. 4th, The use of the pattern gauge and the stem, to govern the circular plate."

139. For an *Improvement in Carriage Springs;* M. G. Hubbard, City of New York.

Claim.—"The employment of a bar extending under the carriage, which, by its torsion, acts as a spring."

140. For an *Improvement in Whiffle Trees;* Isaac Krebs, Winchester, Va.

Claim.—"The construction of a whiffle tree with the continuous sliding bolts or trace fastenings, rods, communicating directly with, and attached to one single and the same lever, together with the staple, one single flexible spring, clevis clips, in combination and through all of which are actuated and retained in position simultaneously at one and the same time, the continuous sliding bolts."

141. For an *Improved Carriage for Steam Fire Engines;* A. B. Latta, Cincinnati, Ohio.

Claim.—"The combination of the piston rod, connecting rod, and cranks, with the shaft, couplings, and driving wheels, so that the same power that operates the fire engine, may, at pleasure, operate the driving wheels for the locomotion of the carriage, or leaving them stationary while the engine is performing its duty. Also, connecting the forward guide wheel to the body of the carriage by the large horizontal ring in which it revolves, in combination with the vertical springs and brace springs for supporting the boxes against shocks experienced in running over pavements and other rough places. Also, combining hooks, rests, or other equivalents, with the body of the carriage, to support the suction hose, without detaching them from the induction parts of the pumps."

142. For *Improved Air Heating Cook Stoves;* Chas. B. Loveless, Boston, Mass.

Claim.—"My improved arrangement of one continuous smoke flue around an oven and against hot air flues, whereby not only are the hot air flues and four sides of the oven subjected to exposure to the heat of the smoke while coursing through such continuous flue, but that the end of the oven and the end of the vertical hot air chamber are also exposed to be so heated."

143. For an *Improvement in Farm Gates;* Henry B. Lum, Sandusky, Ohio.

Claim.—"Having the lower ends of the gate secured by pivots or rods to a sill piece, and having a series of strips placed on sleepers or secured in any proper manner on the ground at one side of the gate, spaces being left between said strips to allow the bars or rods to pass therein, the gate having a weight or counterpoise, one or more, attached to it by a cord or chain which passes over a pulley attached to the post, one or two posts being employed—the gate being operated by the levers with the cords or chains attached thereto."

144. For an *Improvement in Spark Arresters;* David Mathew, Philadelphia, Pa.

Claim.—"The separating head or cone having the surface that is exposed to the current from the chimney, formed of V cavities or projections and openings for the purpose of separating the sparks from the current of gases. Also, the saddle pipe for the purpose of supporting the head and conducting the current of sparks and gases through it."

145. For a *Tool for Grooving Mouldings;* Robt. J. Marcher, Salisbury Mills, N. J.

Claim.—"Forming or cutting transverse and parallel grooves in concave portions of mouldings by means of a tool stock attached to a plate by a pivot which is at the centre of a circle, of which the concave forms a part; the cutter being attached to the lower end of a slide, which is operated or pressed down when the cutter acts upon the moulding by a spring, and elevated upon the return motion of the cutter by raising the lever, the cutter having a stop or guard adjoining it for the purpose of regulating the depth of the cut."

146. For a *Tool for Grooving Mouldings;* Robt. J. Marcher, Salisbury Mills, N. Y.

Claim.—"The reciprocating tool stock, slide, with cutter, one or more, and stopper guard attached to its lower end, and having a spring acting upon its upper end and the slot in the plate."

147. For an *Improvement in Lubricating Compounds;* Jacob Marshall, Reading, Pa.

Claim.—"The combination of whale or other oils mixed with the oleate of zinc, prepared by mixing a solution of soap in water with a solution of acetate of zinc in water, in which the oleate of zinc is separated in a saponaceous mass, while the acetate of soda dissolves in the liquid."

148. For an *Improvement in Sub-Marine Excavating Machines;* Jason C. Osgood, Troy, New York.

Claim.—"1st, The combination of the excavating machinery, the railway track and car, and the well hole deposits of the float or vessel, for the purposes of a self-tending sub-marine excavating boat. 2d, The combination of the drags with the vessel or float."

149. For an *Improvement in Cordage Machinery;* Henry Pearce, Cincinnati, Ohio.

Claim.—"The arrangement of a friction or rubbing collar, operated by a plunger passing upward within the supporting stem, and the weighted lever, or equivalent devices, for regulating the degree of facility of rotation of the bobbin spindles."

150. For an *Improvement in Fences;* J. B. Reyman, Dubuque, Iowa.

Claim.—"The mode of fastening pickets to the rails, in making fences, by means of wire combined and interwoven with the rails. Also, fastening the brace at its upper end to the standard, so as to admit of a hinge motion."

151. For an *Improved apparatus for Drying Grain;* Thos. F. Rowland, Jas. Stevens, and Wm. H. Mason, Brooklyn, New York.

Claim.—"The heating tubes, in combination with the hopper, for partially heating the grain, or other substance, as it passes to the kiln. Also, in combination with the series of perforated or wire gauze shaking pans, the surrounding double metallic casing, the opposite sides of which are connected by horizontal tubes passing under the pans and connected with a steam boiler for the circulation of hot water or steam through the whole casing and connecting tubes, the said double casing being surrounded by masonry; the said combination being for the purpose of more effectually and economically drying grain or other substances without the danger of scorching or overheating it, and to avoid the condensation of the vapors evolved from the grain, or other substance, which, if permitted to take place within the kiln, not only remoistens the grain, but is otherwise injurious. Also, in combination with a kiln consisting of the double casing connected with a steam boiler and surrounding the perforated or wire gauze shaking pans, the employment of a blast of heated air, introduced at the bottom and forced to pass upwards through the kiln and through the perforations in the pans, and to escape at top, for the purpose of driving off the moisture and vapors evolved from the grain or other substance."

152. For an *Improvement in Sewing Machines;* T. J. W. Robertson, City of N. Y.

Claim.—"So arranging and applying the looper, or its equivalent, by which the loop in the needle thread is extended or directed for the purpose of completing the stitch, that it shall derive its movement from the needle."

153. For an *Improvement in Seed Planters;* Edgar M. Stevens and Jos. B. Crosby, Boston, Mass., and Joseph W. Pearson, Winchester, Mass.

Claim.—"The application of elastic surfaced feed rollers in sewing machines, in connexion with an expanding tubed spreader."

154. For an *Improvement in Ox Yokes;* John Tucker, Norway, Maine.

Claim.—"The blocks in which the bows are set, constructed so as to slide upon the rods, in lieu of having them slide upon the under side of the beam, to prevent injury."

155. For a *Mandrel for Cutting Tapering Sticks;* George Turner, Edinborough, Pa.

Claim.—"The construction of my face plate with the two jaws, with the cutter on one of them, and made to close together by means of the right and left screw shaft, moved by means of the cogged wheel and the screw thread on the rim, or by any other construction which will produce the intended effect."

156. For an *Improvement in Curbs for Water Wheels;* John Tyler, West Lebanon, New Hampshire.

Claim.—"Combining the hinged lip with the curb of a water wheel in such a manner that its inner curved surface forms the termination of the scroll water-way surrounding the wheel, whilst its straight surface forms one side of the mouth of the said scroll water-way."

157. For an *Improved Self-Acting Nipper Block;* Jonathan Whipple, Jr., Milford, Mass.

Claim.—"The construction of the same with the one wheel or pulley combined with a ratchet wheel, pawls and levers, and jaw or nipper."

158. For an *Improvement in Telegraphic Key Apparatus;* Leroy S. White, Chicopee, Mass., and Lewis White, Hartford, Connecticut.

Claim.—"In combination with a sliding key circuit breaker, a friction slider, a metallic bar, and an insulated stop bar, or the equivalent thereof."

159. For an *Improved Method of Opening and Closing Gates, &c.;* Caleb Winegar, Union Springs, N. Y.

Claim.—"The opening and shutting of gates or doors by means of a retentive or reserve power, so that a gate or door may be opened or closed a succession of times; let it be obtained by winding up a spring or weight, or whether gear is used, or cords and pulleys. Also, the application of the wires and the right angular irons or elbows to the opening and shutting gates, &c."

160. For an *Improvement in Spikes;* John Henry Wygant, Hackensack, N. J.

Claim.—"Providing a spike with a bevel or inclined offset on one of its sides, and employing in connexion with the same, a light metal bar or locking piece."

161. For an *Improvement in Bank Locks;* Linus Yale, Newport, New York.

Claim.—"The sliding frame and plate in combination with the rods, when constructed so that the plate will, during the operation of unlocking the lock, cover the opening or key hole in the casing before the bolt can be thrown back, thereby preventing the lock from being picked, or impressions taken to form a key. Also, unlocking the lock by means of a segment key, which is placed within a corresponding shaped recess in the plate, by passing said key through the opening or key hole, and moved with said plate, so that when the bolt is thrown back, the recess and key will be in line with or opposite to the opening in the knob, thereby allowing the key to pass out of the recess through said opening into the hand."

162. For an *Improvement in Knitting Machines;* Jonas B. Aiken, Assignor to Jonas B. Aiken and Herrick Aiken, Franklin, N. H.

Claim.—"1st, The needle latch regulator. 2d, The needle latch regulator in combination with the yarn carrier."

163. For an *Improved Water Metre;* J. S. Barden, New Haven, Conn., Assignor to Oliver Stow and G. B. Farnam, Mendon, Conn.

Claim.—"A cylinder of any given size with a common plunger within it, open at both ends and secured within a case, divided into two compartments, each compartment with their heads acting as heads to the cylinder, and reservoirs to receive the sediment either drawn in and not thrown out, or that which may be deposited from the water. 2d, The reservoir for the collection of sediment, whether connected with a cylindrical or a rotary water metre. 3d, The mode of moving and throwing the valve. 4th, The casting or turning of a groove upon the circumference of a piston plate and around its entire diameter, with holes drilled from the base of the same through on the inside. And, lastly, I claim the entire combination."

164. For an *Improvement in Screw Wrenches;* Francis S. Coburn, Ipswich, Mass., Assignor to Ruggles, Nourse, Mason, and Co., Worcester, Mass.

Claim.—"Arranging and combining with the angular recessed head of a handle, a movable notched jaw, operated in manner with respect to the recess of the head, rendering the wrench adjustable to nuts or screw heads of different sizes, and capable at the same time of embracing them on their four sides."

165. For an *Improvement in Burning Fluids;* Abraham Gesner, Williamsburg, N. Y., Assignor to "The Asphalte Mining and Kerosene Gas Company," Assignors to said Gesner, and by said Gesner, to "The North American Kerosene Gas Light Company."

Claim.—"The burning fluid, composed of alcohol and A. kerosene."

166. For an *Improvement in Hose Couplings;* Lucien E. Hicks, Assignor to self and Geo. N. Davis, Boston, Mass.

Claim.—"Combining the two parts or halves of the coupling by means of a locking or bayonet connexion, or the equivalent therefor, and an elastic tube, possessing sufficient elasticity, not only to form, by its expansive power when compressed, a joint under pressure of a liquid within the hose, but to maintain the locking connexions in place when their catch stud is in its recess. Also, making the bearing shoulder conical, or so as to cause the circumference of the tube to be borne against the cylinder seat by the expansive power of the tube acting against such conical part, the same being not only to give support to the tube, but to aid in maintaining a close joint against the pressure of the fluid in such tube. Also, the shoulder tube as combined with the elastic packing tube and one part or half, and used for the purpose of supporting the tube."

167. For an *Improved Swell for Melodeons, &c.;* Thomas F. Thornton, Assignor to George A. Prince and Thos. Stephenson, Buffalo, N. Y.

Claim.—"The divided swell constructed so that one-half (or part) may be used separately when desired for producing more variety in the tone of reed instruments, such as melodeons, melopeans, seraphines, and reed organs, all of which are very similar in construction."

168. For an *Improvement in Sewing Machines;* Joseph Bond, Jr., Philadelphia, Pa.

Claim.—"1st, The spool case with teeth, or their equivalents, on its outer edge, and the nose for catching the needle thread, in combination with the wheel having teeth cut away. 2d, The hollow spool case with its spool in combination with the radiating arm, or its equivalent. 3d, The auxiliary lever as operated by cams on the driving shaft (not for the purpose of controlling the needle thread between the eye of the needle and the goods, as in Harris' and Howes' Machines, nor for the purpose of tightening the stitch as this is done by the needle bar, but) in conjunction with the spool case, so as to accommodate the needle thread as it passes over the spool case, thereby diminishing the extent of movement required in the needles of other machines."

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169. For an *Improvement in Invalid Bedsteads;* Thos. Arnold, Mobile, Alabama.

Claim.—"Forming the main frame or bottom of the bedstead in three parts, the middle part being stationary, and the head part rendered capable of being elevated, and the foot part depressed."

170. For an *Improvement in the Shuttle Motion of Looms;* John Avery, Lowell, Mass.

Claim.—"The hanging of a staff upon a fixed pin or centre, and so vibrating it in regard to the shuttle as that the shuttle shall take its forward motion from the picker staff always with its heel on the rise and its point dipped towards the shed."

171. For an *Improvement in Cartridges;* Charles F. Brown, Warren, R. I.

Claim.—"1st, Making the ends of the metal cartridge case of hemispherical or other convex form. 2d, Providing a water chamber in the rear end of the cartridge case, to be filled with water previously to the insertion of the cartridge in the gun."

172. For an *Improvement in Gas Regulators;* Saml. W. Brown, Lowell, Mass.

Claim.—"The tip valve in combination with the movable top or float of the regulator for operating the tip valve by means of the projections. Also, the use and application of oil and water, or other liquid on which oil will float, for the packing required in my gas regulator."

173. For an *Improvement in Invalid Bedsteads;* E. Daniels, Union, N. Y.

Claim.—"The combination of the body plane, thigh planes formed of two parts, one of the parts being movable, and leg planes, provided with adjustable bars, the movable parts of the thigh planes and the bars of the leg planes being operated by the racks and pinions."

174. For an *Improved Machine for Making Paper Bags;* E. W. Goodale, Clinton, Mass.

Claim.—"1st, Giving the blades of the side shears a curved angular or irregular form, near the point, for the purpose of cutting out each by a single cut, the whole piece necessary to leave the lap on that side of the bag. 2d, Hanging the movable blades of the side shears on shafts or pivots, perpendicular to their faces, for the purpose of allowing them to cut slightly across the fixed blades by a slight lateral movement which they receive simultaneously with the movement usually given to shears. 3d, The intermittently rotating folder, arranged and operating to receive the bag pieces from the feed apron after the cutting and pasting operations, and to support or partly support them until the creasers come into their operative positions, and afterwards to fold them over the creasers. 4th, The combination of the side lappers, and the laterally moving folding stands, operating in conjunction with the creasers. 5th, The toothed roller hung in a frame from the axle of one of the pressing and delivery rollers, and operating to commence the removal of the bags from the creasers. 6th, The general arrangement and combination of the several working parts of the machine."

175. For an *Improvement in Hub and Axle Fastening;* John Henderson, Horseheads, New York.

Claim.—"The peculiar form of the frustrum box fastening."

176. For an *Improvement in Vapor Engines;* Wm. W. Hubbell and David Matthew, Philadelphia, Pennsylvania.

Claim.—"The combination of the distributing perforated pipe or plate, the safety feed pump governed by the pressure and the condenser, or its equivalent, to produce an uniform supply, evaporation, and condensation, or return of the fluid."

177. For an *Improvement in Processes for Treating Auriferous and Argentiferous Sulphurets;* Homer Holland, Westfield, Mass.

Claim.—"The substitution of nitrate of soda, as an improved agent over common nitre for oxidizing the sulphur, for reasons given setting forth the difference."

178. For an *Improved Water Wheel;* Dean S. Howard, Lyonsdale, N. Y.

Claim.—"The combination of the curved sides and twisted buckets, whereby the water is discharged at or about a right angle with its course in the scroll on entering the wheel when the pressure of the water is applied to the convex side of the bucket, the wheel revolving in the same direction that the water passes through the scroll."

179. For a *Fluid Faucet;* Joseph Hollely, Brooklyn, N. Y.

Claim—"The eccentric barrel having an elastic packing on it, acted upon by an eccentric key. Also, facing the rubber packing with metal in combination with the above."

180. For an *Improvement in the Construction of Ear Trumpets;* Edward G. Hyde, Camptown, N. J.

Claim.—"The artificial ear, applied to an acoustic auricle or ear trumpet."

181. For an *Improvement in Swing Bridges;* John A. King, Murray, N. Y.

Claim.—"The combination and arrangement of the springs with the bridge, so that the opening and closing of the bridge shall become automatic, and shall not require the attendance of hands to open or close it, as is usual."

182. For an *Improvement in Cider Mills;* T. J. Kindleberger, Springfield, Ohio.

Claim.—"So arranging the scraper in connexion with the roller, that it shall perform its office without injury to the edge of the knives by means of the cam, for preparing the fruit for the crushing rollers in combination with the apple tilter."

183. For an *Improved Apparatus for Paging Books;* Gabriel Leverich, Wellsburg, N. Y.

Claim.—"The adjustable platforms in combination with the type wheels."

184. For an *Improvement in Buoyant Propellers;* Wm. Lansdell, Memphis, Tenn.

Claim.—"The combination of the hollow threads with the central and lateral water spaces, forming the threads of a screw and securing both flotation and propulsion. Also, the use of the flanch arranged on the regular edge of the segments, having the true pitch of the regular screw. Also, the peculiar wedge-like form of the ends of the segments, having the effect to diminish the resistance of the immersed section of the head while it increases the propelling force at the stem."

185. For an *Improved Mitre Machine;* George W. Labaw, Jersey City, N. Jersey.

Claim.—"The combination and arrangement of the several specific parts (or their equivalents) of the mitre and cutting machine."

186. For an *Improvement in Door Locks;* Wm. Maurer, City of New York.

Claim.—"The arrangement of the notched annular plates, segment tumblers, spring pawl, and band on the casing of the lock and segment bars, for the purpose of connecting and disconnecting the band from the casing and allowing the bolt of the lock to be operated and secured."

187. For an *Improvement in Seed Planters;* Thos. S. Minnis, Meadville, Penn.

Claim.—"The wheel with the sliding or expanding elevators through its side in combination with the lifting box and the spout."

188. For an *Improved Shoe for Grain Mills;* Henry Mellish, Walpole, N. H.

Claim.—"The separating shoe for grain mills, having an inclined barrier, arranged and operating below the screw."

189. For an *Improvement in Pill Making Machines;* Erasmus A. Pond, Rutland, Vt.

Claim.—"The hollow working cylinder with a stationary cylinder inside and eccentric to it, the pits on the outside cylinders being perforated, and the perforations supplied with wires bent, with a ring around the loops, so that the wires are thrust out and drawn in, as the working cylinders revolve."

190. For *Improvements in Forging Machines;* Silas S. Putnam, Boston, Mass.

Claim.—"So combining four hammers together, that not only may two of them be approaching towards while the other two are receding from one another, but that the momentum of the receding hammers may be brought into action upon the approaching hammers, so as to increase the effect of the blow or blows produced by them. Also, two hammers arranged to operate on two opposite sides of a bar, in combination with two hammers arranged to operate upon the other two opposite sides of such bar, each set operating alternately, and the four hammers acting on the four sides and producing an equality of reduction of the bar which cannot be obtained by an anvil (to support it,) and three hammers operating upon the three unsupplied sides of such bar. Also, the manner of constructing each of the connecting rods, in order that it may not only allow its crank to continue its movement when the hammers strike together or upon a bar of metal, but relieve the cranks and connecting rods from the effects of the sudden blows given by the hammers."

191. For an *Improved Grass Harvester;* Francis Peabody, Salem, Mass.

Claim.—"Placing the horses at the side of the driving wheel, when the cutters are placed in front thereof. Also, the mould board in combination with the device employed for the purpose of vibrating the cutter bar, when this device is placed immediately behind the mould board and is connected with the cutter bar by attachments either to the centre or to both ends of the same, whereby a steadier motion of the cutter bar is produced, and the parts which transmit the motion from the driving wheel thereto are covered and protected from being clogged by the grass. Also, the spring regulator constructed and operating for the purpose of adjusting the distance of the knives from the ground."

192. For an *Improvement in Lubricating Compound;* E. F. Prentiss, Philadelphia, Pa.

Claim.—"The manufacture or preparation of a compound which I denominated wool oil."

193. For an *Improvement in Uterine Supporters;* Henry A. Rosenthal, City of N. Y.

Claim.—"The uterine supporter composed of the two supporting leaves and the double shank combined."

194. For an *Improvement in Cut-off Valves;* David Stoddardt, Cincinnati, Ohio.

Claim.—"So arranging the disk connected with the cut-off valve, and in relation to the space below the disk, connecting it by a passage to the cylinder, that the cut-off valve will be operated by steam from the cylinder."

195. For an *Improvement in Grate Bars for Furnaces;* Jacob C. Schlough, Easton, Pa

Claim.—"The mode of constructing grate bars for furnaces, with any convenient number of square or oblong tenons on one side, and a corresponding number of similar shaped mortises on the opposite side."

196. For an *Improvement in Reefing Topsails;* Webster Shibles, Assignor to self and Edward O'Brien, Thomaston, Me.

Claim.—"Combining a windlass yard with the upper topsail yard, and applying the windlass ropes to the outer ends of the windlass yard, and to the topsailyard and topmast, whereby, when the upper topsailyard is lowered, the sail will be furled, and when raised, unfurled."

197. For an *Improvement in Sewing Machines;* Isaac M. Singer, City of New York.

Claim.—"Suspending the feed motion for the purpose of causing the needle to perform two successive operations in one and the same puncture to tie the seam. Also, connecting the pressure pad with its side, or the equivalent thereof, by means of a long jointed arm in combination with the feed wheel, or its equivalent, so that the said pressure pad shall move with the cloth or other substance when fed forward for spacing the stitches instead of making friction, which would tend to pucker or wrinkle such cloth or other substance, and by which, also, the cloth is relieved from pressure after the needle has entered, so that it can be turned freely on the needle as an axis."

198. For an *Improvement in Looms;* Danl. W. Snell, Woonsocket, R. I.

Claim.—"In combination with the yarn beam and mechanism for producing rotary motion of it, mechanism made to operate, and governed in its action by the varying diameter of the yarn beam itself, the same producing upon the yarn beam a positive let-off or regular delivery movement that is independent of, or not governed or controlled either by any positive take-up mechanism, or any mechanism to regulate the delivery of the warps by tension, and rigidly hold them when the lay beats up against the weft."

199. For an *Improvement in Machines for Helically Creasing Sheet Metal Pipes;* Alfred B. Seymour, Claverack, N. Y.

Claim.—"The plate (having a gauge) between the shafts of the creasing rollers, and adjusted by a set screw, so that the proper inclination may be given to the end of the pipe."

200. For an *Improvement in Chairs for Dentists' use;* Richard A. Stratton, Philadelphia, Pennsylvania.

Claim.—"As a new and simple arrangement for raising and lowering and steadying the seats of operating chairs, the annular piece, with its projecting pins and rollers, or their equivalents, in combination with the slotted screw, its nut, wheel, and bracket."

201. For an *Improvement in Grain Drills;* Chapin Street, Barre Centre, N. Y.

Claim.—"The seed distributor with its seed chambers and dust boxes in combination with the cam wheel, spring, and adjusting screws. Also, the peculiar arrangement and connexion with the sliding cam; the lifting board, conductors, and drills."

202. For an *Improvement in Straw Cutters;* Francis Fitzpatrick, Cincinnati, O.

Claim.—"Arranging the rock shaft on which the arms and knife are so placed as to give "a draw cut" in front of the straw box and distant therefrom, so that the tendency of the knife to push away from or leave the straw, shall be resisted or met by the ends of the arms in a line parallel to the thrust, and thus be held up to the straw, whilst the mouth of the straw box is unencumbered by any machinery to prevent the feeding up of the uncut, or delivery of the cut straw."

203. For an *Improvement in Pin Sticking Machines;* J. B. Terry, Hartford, Conn.

Claim.—"Measuring off or gauging the paper to the required unequal distances between the rows of pins, and carrying it forwards to be struck "by means of the feed adjusting ratchet cam operating in connexion with the crimping jaws, or the equivalents of such devices and their operative gear, so that the crimping jaws have their reciprocating intermittent feed or travel regulated to gradually increase for a certain number of feeds, and *vice versa,* that is, the advance action of the crimping jaws made sooner or later, and shorter or longer, without varying their advance terminus to measure out the paper into rows or crimps of gradually increasing distance from either end of the stuck sheet, to secure the flat close wrap of the sheet from its ends towards the centre. Also, in connexion with the forceps, or their equivalents, for taking the crimped paper from the crimper, the double clamps or jaws for holding the crimped paper while the pins are being stuck. Also, the employment of the intermittent revolving cylinder, formed on or round its periphery with rows of parallel grooves of the width of the body of the pin, and corresponding with the grooves in the conductor and arranged in relation thereto as specified, and of the length of a pin or thereabouts, with a notch or recess at the back and for the head of the pin, each groove serving to count out and convey one pin at a time, and the whole serving to count out and convey to their horizontal sticking position the several pins in a row. Also, the manner of operating the distributing cylinder by means of the vibrating arm, operated from an intermittent rock shaft, and having a spring ratchet biting into a toothed disk, or the equivalent of these devices, to give to the cylinder its counting out and conveying action. Also, the employment of a striker arranged at the foot of the conductor, and operating to strike the pin at or near its point, as the pin leaves the conductor to change the position of the pin, and hold it to its seat in the distributing cylinder. Lastly, forming the inclined conductor at its lower end with an off-set covered by an apron, having recesses on its upper edge to allow of the heads of the pins passing there-through, and having a guide on its outer face to carry off the surplus pins."

204. *For an Improvement in Whiffle Trees;* Harvey Webster and Alonzo Webster, Mountpelier, Vt.

Claim.—"The arrangement and combination of the movable spring clamp, its cast-off, its spring latch, and the stationary pin or holder, the whole being applied to each end of the whiffle tree."

205. For an *Improved Corn Grinder and Crusher;* Wm. D. Wilson, Richmond, Ia.

Claim.—"The general arrangement and combination of the crushing rollers, grinding roller, adjustable concave, platform, and gearing."

206. For an *Improvement in Preparing Wood for Paper Pulp;* Milton D. Whipple, Charlestown, Mass.

Claim.—"Grinding the block upon the surface of a revolving stone, or its equivalent. Also, maintaining the block in such position with respect to the stone that the fibres of the wood shall lie in the direction of motion of the stone, or very nearly so. Also, rotating the block during the operation of grinding."

207. For an *Improvement in Vehicles;* E. D. Williams, Wilmington, Del.

Claim.—"The combination of the plate springs and the spiral springs connected or attached to the floor of the body of the vehicle and the perch, and using, in connexion with said springs, the straps for the purpose of preventing sudden longitudinal and lateral vibrations."

208. For an *Improvement in Mowing Machines;* Courtland Wilson and Wm. Moore, Jr., Yardleyville, Pa.

Claim.—"The application of the spring prongs or jaws, and clamp."

209. For an *Improvement in Looms;* Joseph Welsh, Philadelphia, Penn.

Claim.—"Actuating the picker stopper by means of the shuttle, which is to be relieved from the picker, and so that the tip or point of the same may be finally relieved, before the box containing it commences to move, or by means of the stud in combination with the rock shaft, or its equivalent, adjustable arm, and moving stud, irrespective of the action of the shuttle upon the swell."

210. For a *Machine for Making Paper Bags;* Francis Wolle, Bethlehem, Penn.

Claim.—"1st, The conveyor for conveying the folded paper to the apron, by which it is carried to the folding and lapping apparatus. 2d, The construction of the lappers, and their connexion with their respective lapping tables. 3d, The arrangement of the drying chamber and the aprons which convey the bags through it, so that the bags are severally delivered to the aprons with their sides in a position oblique to the direction in which the aprons move, and thus, as they are successively deposited, have the wet laps of their sides and ends left uncovered by their successors. 4th, The general arrangement and construction of the whole of the machinery, whereby a piece of paper of suitable length is cut from a roll, cut out to the proper shape, folded, pasted, lapped, printed in any desirable manner, and dried, at one continuous operation.

211. For an *Improvement in De-Vulcanizing India Rubber;* Segismund Beer, Assignor to Lewis Feuchtwanger and Segismund Beer, City of New York.

Claim.—"The restoration of caoutchouc, gutta percha, or other similar gums which have undergone the process of being cured or vulcanized, so that those gums may be capable of being used again as a substitute for native gums of like character or in combination with such gums, by first treating the vulcanized gum with alkalies, or compounds of alkalies and oils (as potash with any common grease or oil) for extracting the sulphine, &c., and then submitting the mass to the action of heat, and turpentine, or any other liquid known to be a solvent of the gum in its natural condition."

212. For an *Improvement in Sewing Machines;* Addison Capron, Assignor to self, Joseph S. Dennis, Somerville, Mass., and Henry M. Richards, Attlebero', Mass.

Claim.—"Combining the needle with the main carrier by means of a secondary carrier and a spring, or the equivalent thereof, applied to the main carrier."

213. For *Improvements in Hand Pegging Machines;* Alfred Swingle, Assignor to Elmer Townsend, Boston, Mass.

Claim.—"So combining the peg chisel or cutter with the spring slider and the peg receiving and discharging passage thereof, that such peg cutter shall be moved upwards with and by the slider, so as to separate a peg from a strip of peg wood, the same rendering it unnecessary to employ a spring bottom to the magazine, as is required when the peg wood is moved against the knife. Also, the manner of applying the spring to the peg wood driver and magazine, viz: by employing an elastic band spring, fastening it at its two ends to the magazine and the driver respectively, and making it to play around a grooved pulley applied to the handle or magazine."

214. For an *Improvement in Pads for Hernial Trusses;* Lucien E. Hicks, Boston, Mass., Assignor to self and Hiram L. Hall, Beverly, Mass.

Claim.—"1st, An india rubber pneumatic truss-pad without opening or valve, and filled with compressed air. 2d, Making the top of the pad thicker than the bottom or cushion, whereby the former is rendered sufficiently rigid to allow of the attachment of the shank, while the cushion maintains its entire elasticity. 3d, Sinking the button beneath the surface of the pad within the cavity and securing it therein by the flanch, by which means the button is surrounded by the annular cushion, and is prevented from coming in contact with the person."

215. For *Improvements in Burning Fluid Compounds;* Abraham Gesner, Williamsburgh, N. Y., Assignor to "The Asphate Mining and Kerosene Gas Company," re-assignors to said Gesner, and by him assigned to "The North American Kerosene Gas Light Company."

Claim.—"As a new manufacture, or composition of matter, I claim the burning fluid composed of alcohol, and B. kerosene."

216. For an *Improvement in Amalgamating the Precious Metals;* Leander R. Streeter, Assignor to self and Ira Leonard, Lowell, Mass.

Claim.—"Forcing mercury at any required degree of pressure into ores to be amalgamated, when the ores are enclosed in a mercury tight cylinder or receiver."

ADDITIONAL IMPROVEMENTS.

1. For an *Improved Mode of Regulating the Furnace of Hot Water Apparatus;* Thos. T. Tasker, Philadelphia, Pennsylvania; dated May 8, 1855; original patent dated December 5th, 1854.

Claim.—"The arrangement of the three dampers or valves, and their several connecting rods, in combination with a single float placed in the open tank above."

2. For an *Improved Machine for Sawing and Planing Clapboards;* Ephraim Parker, Rock Island, Illinois; dated May 15th, 1855; original patent dated Dec. 20th, 1853.

Claim.—"The peculiar mode of hanging the front cutter or plane, or its equivalent. Also, the manner of hanging the saw, or its equivalent, so that they will adapt themselves to the different thickness of boards. Also, in combination, or either one when operating seperately."

3. For *Improvements in Machinery for Crushing Quartz, &c.;* James Hamilton, City of New York; dated May 22d, 1855; original patent dated January 3d, 1854.

Claim.—"The combination of the weighted levers and adjusting screws with the pestle, set and moving on the shaft."

RE-ISSUES FOR MAY, 1855.

1. For *Improvements in Machinery for Reducing Metal Bars;* Dexter H. Chamberlain, Assignor to Cyrus G. Howard, Boston, Mass., Assignor to Peter Cooper, City of New York; dated May 15th, 1855; original patent dated January 18th, 1853.

Claim.— The method of rolling bars or rods on four sides by the combination of three rollers arranged with the axes of two of them parallel and the third at right angles thereto, whereby two opposite faces of the bar or rod are drawn between the two rollers on parallel axis, and the other two faces between the periphery of the third roller and the face of a cavity formed in one or both of the other rollers. Also, in combination with the three rollers combined and arranged, the employment of the bolster to prevent the forming of a fin on the bar at the junction of the two parallel rollers."

2. For an *Improvement in Endless Chain Horse Power;* Alexander F. Wheeler, Ex'r of Wm. C. Wheeler, dec'd, and Alonzo Wheeler, Albany, New York; patent dated May 22d, 1855; original patent dated July 8th, 1841.

Claim.—"The links of the parallel endless chains which carry the traveling bed, formed with cogs on their inner edge meshing into the side pinions on the driving shaft, when the latter is arranged back of the forward end of the power to receive motion by the straight run of the cog links over the said pinions."

3. For an *Improvement in Bleaching Apparatus;* Charles T. Appleton, Roxbury Mass., patent dated May 22d, 1855; original patent dated April 17th, 1855.

Claim.— The combination of one or more air-tight vats for receiving and containing the goods, an apparatus for exhausting the air therefrom, and the necessary vessels for containing the liquids used in the process of bleaching, whereby the various steps may be performed in a much shorter space of time than has heretofore been required."

DESIGNS FOR MAY, 1855.

1. For *Cooking Stoves;* Benj. Wardwell, E. R. Barstow, and G. C. Harkness, Providence, Rhode Island; dated May 8th, 1855.

Claim.—" The ornamental design and configuration of the side of the stove, inclusive of its base and cornice mouldings. Also, the ornamental design of the larger door, and that of each of the doors. Also, the ornamental design of each door, that of the hearth plate, and that of each of the legs."

2. For *Equestrian Statues;* Clark Mills, Washington D. C.; dated May 15th, 1855.

" The nature of my design relates to an equestrian statue in which the horse is rampant, and so poised as to be supported on his hind legs only, and mounted by a rider."

Claim.—" The design for an equestrian statue."

3. For *Water Coolers;* George Hodgetts, City of New York; dated May 22d, 1855.

Claim.—" The design and configuration of the parts forming a water cooler."

4. For *Cooking Stoves;* Samuel D. Vose, Albany, N. Y.; dated May 29th, 1855; ante dated April 9th, 1855.

Claim.—" The arrangement and combination of the several figures and mouldings, the whole forming an ornamental design."

5. For a *Cooking Stove;* Samuel D. Vose, Albany N. Y.; dated May 29th, 1855; ante dated April 9th, 1855.

Claim.—" The arrangement and combination of the several figures and mouldings, the whole forming an ornamental design."

6. For *Cooking Stoves;* Samuel D. Vose, Albany N. Y.; dated May 29th, 1855; ante dated April 9th, 1855.

Claim.—" The arrangement and combination of the several figures and mouldings, the whole forming an ornamental design."

7. For a *Parlor Stove;* Samuel D. Vose, Albany, N. Y.; dated May 29th, 1855; ante dated April 9th, 1855.

Claim.—" The arrangement and combination of the several figures and mouldings, the whole forming an ornamental design."

8. For *Sewing Birds;* John North, Middletown, Conn.; dated May 29th, 1855.

Claim.—" The design for sewing bird."

9. For *Parlor Stoves;* Abner J. Blanchard, Assignor to Blanchard, Tarbell & Co., South Reading, Mass.; dated May 29th, 1855.

Claim.—" The composition of mouldings and the ornaments in relief, on the front plate, base plate, and cornice or top plate; and, also, the peculiar design or configuration of the urn, and that of each of the blowers."

10. For *Cooking Stoves;* Abner J. Blanchard, Assignor to Blanchard, Whittemore, & Co., South Reading, Mass.; dated May 29th, 1855.

Claim.—" The design of each of the doors, that of the side plate, the larger hearth plate, and the leg."

J. FOUSER'S APPARATUS FOR REMOVING AND REPLACING THE WHEELS OF LOCOMOTIVES CARS &c.

FIG. 1.

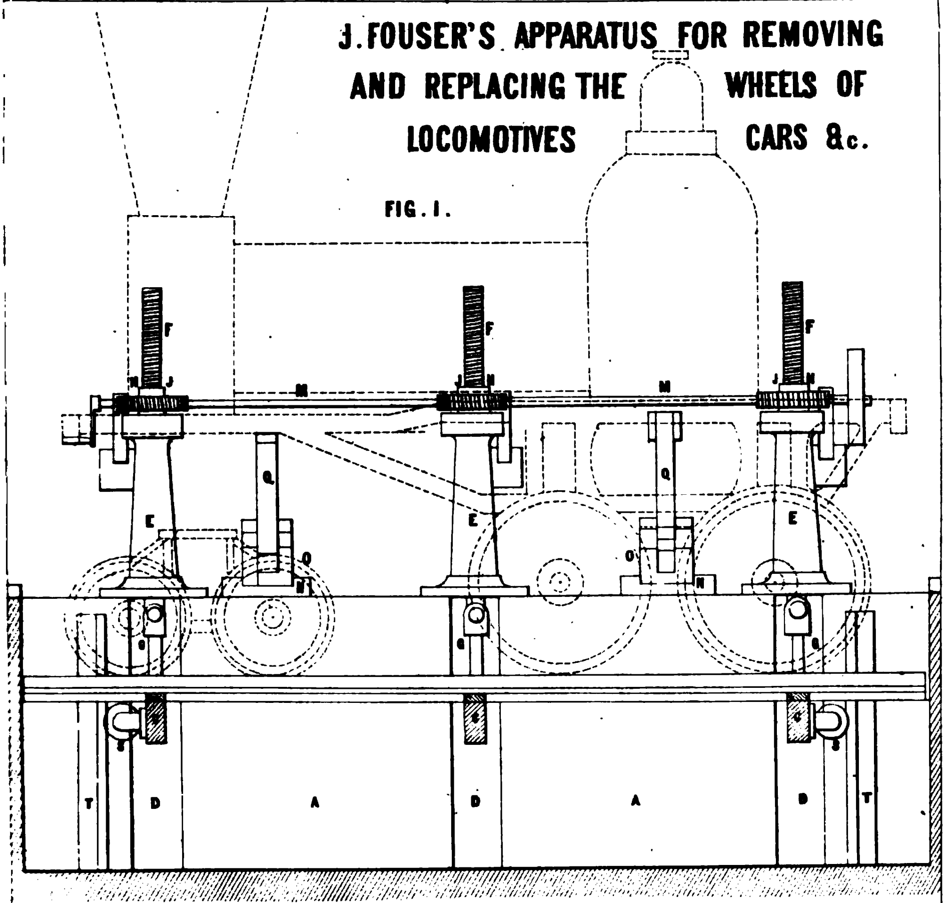
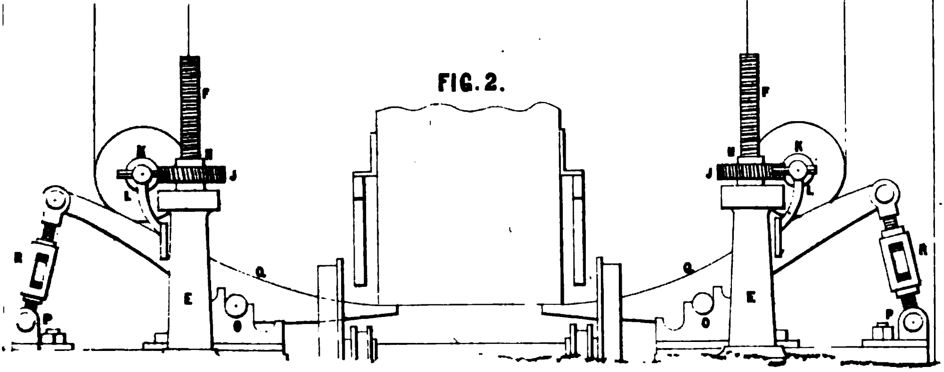


FIG. 2.



MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Description of Apparatus for Removing and Replacing the Wheels of Locomotives and Cars. Invented by JOHN FOUSER of Philadelphia. By H. HOWSON, Civ. Eng.

One of the greatest inconveniences attending the repairing of locomotive engines and cars, is the fact, that those parts which through wear and tear are most liable to get out of order, are the most difficult of access.

The continual necessity of examining and renewing the axles and bearings as they become worn or otherwise deteriorated, forms no small item in the expenditures of railroad companies, and the preparatory and tedious process of removing the axles, in addition to the material and workmanship, conduces to render such repairs most costly.

This will be apparent when we recollect, that to remove and replace the wheels and axles of an ordinary eight-wheeled locomotive by the use of common screw-jacks is, at a moderate calculation, the combined work of four men for ten hours.

It is true, that in some instances the use of ponderous cranes for raising the entire superstructure from the axles has been resorted to, and on some of the lines in France, extensive and complicated arrangements of movable platforms, operated by racks and gearing, have been brought into practice to effect the required removal.

Throughout the numerous railways in this country, however, the old fashioned screw-jack is still the favorite implement for effecting the abovementioned purposes; and it is somewhat singular, that an instrument so slow in its operations and tedious to manage, has not, ere this, been replaced by more rapid and tractable appliances.

The annexed engraving (Plate IV,) represents two views of Mr. Fouser's apparatus for removing and replacing the wheels and axles of locomotives and cars.

The inventor is a practical machinist, and his experience both in the workshop and on railroads, has shown him the many difficulties attending the repairing of locomotives, and has induced him to design a simple and efficacious arrangement, by which the most important of these difficulties may be overcome.

Measures have been taken to secure the invention by patents, both in this country and abroad, and active preparations are being made to bring it into actual operation.

Fig. 1, in the engraving, represents a longitudinal section of the apparatus in question, showing the truck and driving wheels as in the act of being removed.

Fig. 2, is a transverse section of the same.

A is a pit in a line with the rails of a track in a locomotive repairing shop; in some cases it may be situated on the main line. B is a platform with longitudinal rails corresponding in width of gauge with those of the adjacent track. The platform is nearly of the same size as the pit, sufficient spaces being left between the sides of the pit and edges of the platform to allow the latter to be raised and lowered within the former, without coming in contact.

Underneath the platform are strong cross pieces or beams, C, the ends of which project into recesses D, left in the sides of the pit. E are cast iron columns on the edge of the pit, and secured to the masonry or brick-work immediately above the recesses, D. Through these columns pass the screws F, which are connected to the ends of the cross-pieces, C, by means of the jointed rods G. H are the nuts, which have flanches at their lower ends, confined by means of caps within the tops of the columns in such a manner that the nuts may turn freely without the possibility of moving vertically. To the nuts H, and above the columns, are screwed the worm-wheels J, and gearing into these are the worms, K, on the horizontal shafts M, which have their bearings on brackets, L, secured to projections on the columns.

To the masonry on each side of the pit and between the columns, are secured the plates N, having flanches, which confine laterally the adjustable blocks, O and P. Both these blocks are arranged so as to be easily moved backwards and forwards and rendered stationary at the position required, by ordinary bolts.

It will be observed that the blocks, O, have three sets of bearings, into either of which may be placed the pins which form the fulcrums of the levers Q, the long arms of the latter being connected to the sliding blocks P, by means of the adjustable rods R.

S S are flanched rollers hung on brackets secured to the sides of the cross-pieces C, and bearing against the rails T, on the sides of the pit, so as to serve as guides for the platform when in the act of being raised or lowered.

Previous to the apparatus being brought into operation, the platform is raised to a level with the ground, so that the rails on the platform and track correspond. Should it be necessary to remove the driving wheels only, that portion of the locomotive to which they are attached, is moved over the platform, the other portion remaining on the permanent track.

The levers Q are now adjusted, so that the points may bear against the under edge of the fire-box, as shown in Fig. 2, or under some portion of the frame-work, and the axles being disconnected, the platform is lowered, and with it the wheels and axles, by turning the shafts M. When sufficiently low, the wheels are rolled to the end of the platform, and clear of the engine, when they are again raised by turning the shafts, M, in a contrary direction, until they are again on a level with the permanent track, along which they may be moved to any distance required. A supplementary truck may now be placed under the fire-box and the engine removed away altogether, or placed above the platform, so that the other wheels may be removed. It is the intention of the inventor, however, in central localities, to make the pit and platform so much longer than the locomotive, that the whole of the wheels may be removed at one raising and lowering of the platform.

It will be seen, that the levers Q can, through the sliding boxes P and Q, and adjusting screw R, be regulated to suit almost any difference which may occur in the construction of the engines.

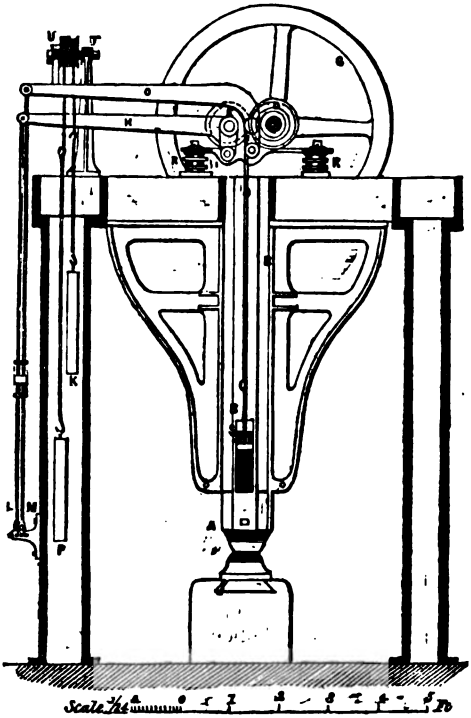
It is occasionally requisite in replacing the wheels and axles, that one wheel should be raised higher than the other. By Fouser's apparatus, this can be easily done by turning one of the shafts, M, while the other remains stationary; thus giving an inclination to the platform, which, on account of the jointed rods G, in no way affects the proper working of the screws F.

In repairing shops, power may easily be applied to the shafts M, by straps passing upwards and crossed overhead so as to clear the chimney.

By the use of his contrivance, the inventor calculates to be able to remove the wheels and axles of an eight-wheeled locomotive in less than an hour, two men only being required to assist in the operation.

On an Improved Friction Hammer. By James Kitson, Leeds.*

The hammer represented in our engraving has been in use for some time at the author's works, Leeds, where it was originally constructed as a simple and inexpensive hammer, for the heavier smiths' work; and the present description has been prepared only in compliance to a request to communicate to the Institution the particulars of this hammer, as possessing some practical advantages of efficiency and simplicity.



The hammer block A, weighing 5 cwt., is guided by grooves in the same, BB, and is lifted by the flat wrought iron friction bar CC, 5½ inches wide, and ⅝-inch thick, fixed into it by a T head, with two cutters, SS.

The friction bar C, is raised by two rollers D and E, carried on the cross frame at top, one of which D, runs loose on its axle, and the other E, is fixed on a shaft which is driven continuously by a pulley, and carries a fly-wheel GG, at each end, to give momentum for lifting the hammer.

The axle of the roller D, is carried by a bent lever H, which works on a fixed centre I, below the roller, and has a chain connected to the outer end, passing over a pulley T, and attached to the weight K. This weight presses the tightening roller D, towards the driving roller E, and grips the friction bar C, between them, causing the hammer to be drawn up rapidly; the hammer being prevented from being lifted too high by a timber stop at the top of the frame.

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*From the Lond. Civ. Eng. and Arch's. Jour. February, 1855.

A handle L, is connected by a rod to the extreme end of the lever H, and by pressing down this handle, the tightening roller D, is drawn back slightly, releasing the friction bar C, and allowing the hammer to fall. On releasing the handle L, from the pressure, the hammer is again lifted by the bar being gripped between the rollers, and it is again let fall from any height desired by pressing down the handle.

The man holding the handle has thus complete control over the hammer, by simply pressing down the handle, or letting it rise again; and he can readily regulate the rapidity, or length of the stroke, as required. The present hammer makes from 25 to 30 strokes per minute, when lifted to the full height, 5 feet; about 40 per minute with a stroke of 2 feet, and 84 per minute with 14 inches length of stroke. The driving pulley makes 132 revolutions per minute, when the hammer is at work.

The second handle M, works a friction clip or break N, serving to check the hammer, and hold it fast in any position. This brake N, is fixed at the end of a second bent lever O, working on a centre below, and lifted by a chain U, and a second weight P, working by the side of the other weight, inside one of the hollow columns of the framing. This weight presses the brake towards the tightening roller D, the lifting bar being gripped between them by the opposing pressure of the two weights, holding up the hammer in any position that it may be in.

The brake handle M, is held down continuously whilst the hammer is working, the man holding this in one hand, and the lifting handle L, in the other hand; by means of which the working of the hammer is managed with great expedition and accuracy, and it can be instantly stopped and held fast whenever required, by merely letting go the brake handle.

The frame that carries the bearings of the lifting rollers and break, is mounted upon four india rubber springs RR, fixed upon the main cross frame, for the purpose of relieving the friction bar from the shock of suddenly putting the hammer into full motion, when the lifting rollers lay hold of the bar; the india rubber springs are compressed at the first moment, allowing the lifting rollers to drop a little, whilst the hammer is getting into motion.

The bottom end T of the friction bar, is bedded upon several thicknesses of wood, 12 inches thick in all, fixed in the hammer block, the elasticity of which relieves the lifting bar from the end concussions, when each blow of the hammer is struck.

When this hammer was first constructed, the friction bar, which was rather smaller, 4 inches by ⅜-inch, was fixed in the hammer with a single 4-inch piece of wood below it, and the india rubber springs were not adopted; and it was found that the cotters SS, broke very frequently, about twice a week. India rubber ⅜-inch thick was then put in between the cutters and T head of the bar, with a better result; and the india rubber springs were afterwards introduced, with the wood packing below the T head of the bar; this arrangement has been found to work very successfully, and it has been in regular work for the last nine months without accident or repair.

The only wear that is found to take place in the machine, is in the friction bar, near where it is first caught by the lifting rollers, for a length of about 14 inches; the wear being at the rate of nearly ⅛-inch thickness per week, when in constant work. This repair costs very little time and expense, requiring only smiths' work; but in the case of making another similar hammer, it would be preferred to make the bar 7 inches wide instead of 5½ inches, to diminish the wear.

For the Journal of the Franklin Institute.

On the Framing of Steam Engines. By THOMAS D. STETSON, M. E.

In all scientific investigations of the proportions, &c., of the steam engine, a large share of attention has uniformly been bestowed on the cylinder, the valves and passages, the speed of piston, and even the thickness and form, as well as length and motion of all the working parts, but little or nothing has been said of the framing by which the whole is supported. Certain points have been assumed as "fixed," and the precise method of fixing, or even a suggestion with regard to how this may be best accomplished with the least labor and material, has been left to the unaided judgment of the designer in each particular class. In some cases this judgment or taste of the draftsman is very nearly perfect, but in general it is only imitative, and frequently exhibits a most deplorable lack of both intuitive and scholastic science by adopting and perpetuating very nearly the worst possible forms. The facility with which complicated forms may be reproduced and multiplied in cast iron, has led properly enough to the exhibition of considerable architectural taste in the framing of beam engines for stationary purposes. But this display, when it leads to the construction of a series of vertical columns, supporting an entablature above, becomes an abomination at which the sensitive mind revolts as from the leaning tower at Pisa. There are particular cases, it is true, in which circumstances justify the expenditure of much material and labor to construct a cumbrous frame which shall excite admiration by its grace or inspire awe by its extent. The pumping engine at the Brooklyn Navy Yard, is an example of the latter effect, and the sensations produced in the beholder by the immense canopy of castings, glittering with bronze, are no doubt the main end and aim of the construction. The fact that the frame is some inches too large in each direction for the house in which it stands, required that the solid granite should be grooved out to that extent on two sides of the building, but this was evidently a mistake, as also may have been the whole design of the framing. More probably, however, it was a study for effect, an end which was well served by constructing a fancy architrave with pillars, steadying the whole by leading massive girders from its top to the four walls of the building, and supporting their extremities by pilasters. Less wealthy employers, however, prefer in general to make a less ostentatious display, strength and stiffness being the main objects, and overwhelming effect only a matter of fourth rate importance.

English engineering presents numerous examples of the same kind of frame, or of what is little better, a solitary pair of vertical pillars rising from the centre of the bed-plate and steadied by bracing horizontally from their top to the walls of the engine room. And it is but a few years since a large beam engine was erected in a rope-walk in Plymouth, Mass., by one of our best Boston builders, on substantially the same frame as the pumping engine alluded to, but without the spreading canopy of arms. To the eye of the public, and even to some tolerably skilled mechanics, there is a peculiar beauty in this rich entablature and clustering columns, but upon loading the engine and admitting the steam at full pressure, the wrenching strains arising from the inclined positions of the links and connecting rods through which all the force is transmitted, rocked the frame like an inverted pendulum. The remedy was the adding as an afterthought, of several stiff braces from the end of the entablature to the wall, a simple method of transmitting to the stronger structure, an ague which should never have been inherited from its English prototype.

The ancient Hindoos and Indians sculptured their buildings with real and imaginary animals and vegetables by way of ornament; the Egyptians combined the tent of the wanderer with the cavern of the hills, and developed the heavy pyramidal masses which we call Egyptian architecture. The Greek combined both the ornament and massiveness of the above with the light cabin-like structures of their primitive condition, and produced the beautiful Doric, Ionic, and Corinthian, but all the popular and unpopular forms of architecture derive their chief attraction from their fitness. Habit and custom has made even the unornamented arch of the Romans a perfect picture of substantial grace and beauty, but the pleasure it inspires springs, at least originally, from its most obvious and extreme utility. In all these cases the mason and stonecutter were contending against the simple gravity of masses at rest, but the possession of the founder's art and the varying and angular nature of the strains upon a reciprocating steam engine, make the effort for architectural effect in the general contour of an engine frame as puerile and ridiculous as would be an attempt to make a railroad car resemble a donkey, or a steamboat cabin the side-saddle on which our grand parents rode to church.

In the horizontal or vertical direct-acting engine, there is a considerable lateral force arising from the pressure of the gibs of the cross-head upon the slides, but the principal strain upon the frame is a direct thrust and pull, equal to the action of the steam upon the piston. The pressure of the gibs upon the slides depends on the length or rather on the shortness of the connecting rod, and may with a little care be obtained by the geometrical decomposition of forces. Or it may be obtained by multiplying the available pressure on the piston by the tangent of the angle made by the connecting rod at any moment.

The *amount* of the strain may not be of any considerable consequence, since, however great it may be proved, the occasional presence of water in the cylinder requires a large surplus of strength in all the parts. But the *direction* of the forces acting at certain points is a matter of serious moment, as either from total ignorance on this point, or the most culpable neglect in matters of so much importance, most hideously distorted frames have been designed and brought into existence both in manufactories and in the hulls of otherwise splendid steamers.

The direct-acting engines, whether Copeland's inclined condensing, or the many forms of propeller engines, and high-pressure timber-framed machines on our western waters, may be dismissed by simply remarking that *the strain on the shaft at the centre of the crank is always in a line parallel to the axial line of the connecting rod, and equal in amount to the effective pressure on the piston multiplied by the secant of the angle between the connecting and piston rods.* In the square engine there is required little in fact that deserves the name of frame except the vertical slides which guide the cross-head. The beam engine and oscillating, now decidedly the two most popular for all general purposes, are most open to suggestion, and on these classes let us bestow a few moments close attention.

The beam-centre, whatever the manner in which it is supported, sustains a strain equal to about twice the effective pressure upon the piston, and the direction of this force depends on which end of the cylinder is receiving steam, and also on the inclination and relative force transmitted through the front-links and connecting-rod. The links give an alternate thrust and pull, equal to the whole action on the piston, multiplied by the secant of the angle at which they stand. Transfer this strain, or suppose another equal to it acting at the beam-centre in a parallel direction and with the same intensity, we thus obtain one portion of the strain upon the centre. Next decompose the force exerted by the front-links and find what portion tends to give motion to the beam. Draw a line perpendicular to the beam at its other extremity and find by what angle the connecting rod varies from this line. Multiply the force just found by the secant of this angle, and the result is the amount of thrust or pull on the connecting rod. Transfer this force or suppose another similar to be acting at the beam-centre in line parallel to the position of the connecting rod and in a direction the reverse of its motion. This makes the other portion of the force acting on the beam-centre, and by compounding these strains, and obtaining a third equal to both the former, we obtain the actual strain.

Were the front-links and connecting-rod infinitely long, the strain on the beam-centre would be always vertical, forcing it directly up or directly down, and the amount of force would, in all cases, be twice that on one end of the beam alone, or on the piston. This condition is equally true whether the beam be at rest or in motion, since whatever force is exerted at one end is always reproduced at the other, increased or diminished very slightly by inertia. The common grocer's scales furnish an instance of a force acting on an equal beam against a balancing force, and the centre is of course compelled to bear the weight of both.

It is a comparatively easy matter to project on a large side elevation of a given beam engine the true directions and amounts of the strains at every moment of the stroke; modifying it, if necessary, by the varying pressure of the steam consequent on its expansion. This may be a pleasant amusement for the amateur and may be necessary to the designing of a strictly perfect frame, not forgetting of course to provide for working backwards, nor to allow for the effect of the slides, air-pump links,

&c., but this is labor which is unproductive and unnecessary. It is sufficient for our present purpose to show that the strains are not always, nor indeed generally vertical, but vary to an extent nearly equal to the greatest angle of the connecting rod. The mechanic who would mount such a centre on a series of vertical pillars without a single diagonal brace, would sit on the branch of a tree till he had sawed it off, and broken his leg in the fall. But this is not all. The bed-plate or some fixture connected therewith requires a strength and stiffness equal to that of the beam. At one extremity is the cylinder, and at the other the crank pillow block alternately striving to jump up or plunge down together with all the energy of the imprisoned vapor. Above them is the beam pillow-block, which is, as we have seen, always impelled at the same moment in a nearly opposite direction with a force equal to both. What can be simpler than to connect them by a triangular frame, and relieve the bed-plate and all the parts at once from any strain except that of simple extension and compression.

Messrs. Corliss & Nightingale, of Providence, the most extensive and successful builders of large stationary engines in America, construct all their frames in a style very closely approximating this form. The frames are two upright castings with braces of wrought iron extending diagonally in both directions from points near their tops. Theory indicates points nearly abreast of the cylinder, and of the pillow-block, as the proper attachment for these braces to relieve the bed-plate, but as it is of more importance to support the beam properly, the divergence of these diagonals is not far from correct. For either purpose, however, they should range exactly towards the axis of the beam-centre, unless some consideration of convenience overrules.

Otis Tufts, of East Boston, constructs a frame very nearly approximating to the form described, making it all of cast iron and possessing considerable architectural grace.

Mr. T.'s castings all appear to be on a cursory examination, enormously heavy, to which point as much perhaps as to their nearly correct form may be due the fact (referred to with honorable pride by the principal of the establishment) that although some fifteen years a builder of this kind of machinery, his engines have never yet failed in any principal part.

The well known and popular firm of I. P. Morris & Co., Philadelphia, have constructed a style in which the beam pillow block is carried on large hollow castings resembling truncated pyramids. This pattern, an example of which is running, or was a year since, in a large cotton mill in Lancaster, Pa., is capable, by spreading sufficiently, of making a very successful approximation to the triangular truss desired, or if much too narrow may be supported by inclined braces, as was the case with the engine observed.

A very elegant, light, strong and in every respect desirable frame may be constructed of gothic arches dexterously applied together, and with a little effort not only the general form of a triangle may be preserved, but the metal may be so distributed that the strains in the directions already indicated may be carried in almost a right line. The Novelty Iron Works, New York, have recently constructed several in this style, two of which may be seen at the Empire Iron Works at Twenty-fifth Street, and approach more by accident than by design to the true mathematical form.

In the oscillating engine the strains are extremely simple, and on this account this class might with propriety have been the first instead of last in our investigation. In this class the trunnions and pillow-blocks are always thrust apart or drawn together with an energy exactly equal to the effective pressure on the piston. The direction of the force is always in or parallel to the line of the piston rod. Assuming that the cylinder be directly beneath the crank, the frame of least material is evidently two triangles both resting on the same base; but leaving out of the question the disposition of material below the trunnions, it may be sufficient to observe that the pillow-block should be supported on a stout triangle, the sides of which incline to an extent equal the greatest inclination of the piston rod. The framing of the engines of the steamship "*Knoxville*," designed by Mr. D. G. Wells, approximates to this, the wrought iron standards spreading at the bottom, and ranging upwards towards a point some feet above the centre of the shaft. In this case there is a necessity for this in order to conveniently remove the cylinder cover, but in the Corliss beam engine alluded to above, the braces range toward a point considerably below the beam-centre for no assignable reason, although in every other feature the Corliss Engine shows a masterly struggle for complete perfection of every detail.

It may seem invidious to point out instances where these principles have been overlooked. Attention has never been called particularly to their importance, and in fact the direction and intensity of the strains has probably never before been analyzed in print. The result is, that our shops, manufactories, and steamships, are full of large, and in many respects splendid engines, but with miserable abortions as substitutes for frames. "Mone's Treatise on American Engineering," the latest and best collection of detail drawings ever published in America, spreads before the world a beam engine with the beam mounted on a single pair of pillars, unsupported except by the building in which it stands, and the design being already published may be alluded to with freedom. "Stuart's Naval and Mail Steamers" has given correct drawings of the "*Golden Gate*" and "*Illinois*," in both which vessels the pillow-blocks are carried on stout vertical columns, with slight and almost insignificant diagonal braces. America can do better than this, and is doing it, yet for want of a distinct enunciation of a few principles, obvious enough when once fully presented, we continue in too many cases to imitate and perpetuate error.

New York, May 23d, 1855.

For the Journal of the Franklin Institute.

Description of Improvements in Feeding and Circulating Water in Steam Boilers. Patented by Thos. Champion, of Washington City, D. C.

The annexed engravings represent Thomas Champion's patent mode of feeding and keeping up continuous rapid circulation in steam boilers, through a sprinkler, and his patent furnace and direct action exhaust steam blower, which saves all the room, expense, and friction of a mechanical blower, and all the heat of the exhaust steam and fuel after the engine is in motion.

The present engravings show these improvements attached to two of the common double flue cylinder boilers, such as are used for stationary engines and for western steamboats, but they are applicable to all kinds and purposes. Letter A, is a pipe to which the feed pump or supply pipe is attached; B is a valve in said pipe hinged above at its junction with pipe C, which intersects above with the boilers at or near their bottom; D are coils, the extension of pipe A round the surface, to protect the plates from the intense heat of the coal, forming sides or a basket for the fuel above the grate, after which the coils or turns may be still further extended into a hollow grate E, in a square furnace such as the present; the convolutions are not round, but are turned suddenly at each corner, until a hollow grate is formed and the tube at F extended through the fire space to the rear end of the boilers, where it is divided into as many branches as may be deemed requisite, to have sprinklers G, extending through the length of the boilers, to which these branches are united, to spray or jet the plates on any or every part of the fire surface should it become bare of water.

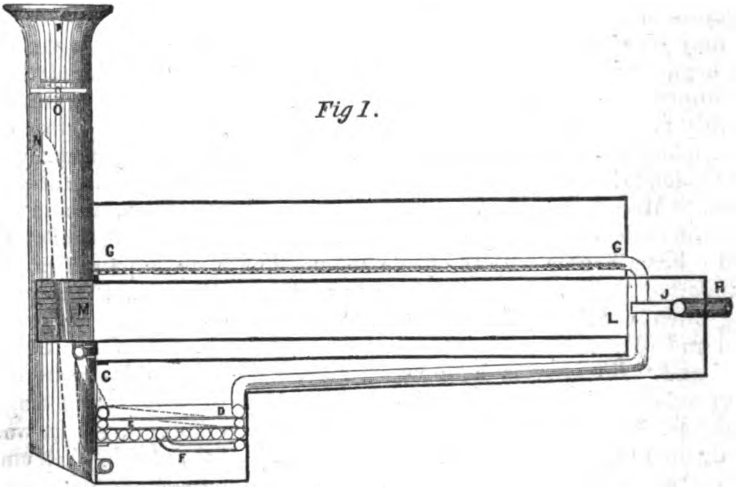

Fig 1.

The sprinkler is pierced with a series of small apertures at the proper angles, to sprinkle part or the whole of the internal surface, where fire is acting on the opposite sides of the metal. While the pump is feeding or the supply passing into the boiler, the valve B will raise with the pressure under it, closing the pipe C, and the feed-water will pass on through the coils, grate, tube, and sprinkler, entering the boiler intensely heated; but should the pump fail to supply, the steam and hydrostatic pressure in the boiler and pipe, C, will then open the valve B, and admit the water from the boiler into the coils, and the intense heat to which these coils are subjected cause the hot water and vapors to pass upward with continuous rapidity through the sprinkler, jetting and spraying the plates, whether the pump is feeding or not, so long as any water remains in the boilers; thus all the water may be evaporated, the steam exhausted, and the engine stopped, yet no explosion take place, nor even the boiler be injured, provided the fire be extinguished as soon as the engine shows signs of stopping. With one-third the usual quantity of water in the boilers, and the continuous showering of the plates, renders the evaporation three times more effective, and the mode of feeding cold water round through the coils in contact or nearly so with the fire-box plates, admirably prevents their destruction, and saves much heat and loss in replacing burnt grate bars.

For single or double flue cylinder boilers is also placed a drying pipe I, in the rear end of the fire space, into which the exhaust steam from the engine is conveyed by the pipe H; the drying pipe has as many exit pipes J, conveying the exhaust steam into the centre of each flue of the boiler, to force the return of the unconsumed heat, smoke, and gas, from underneath the boilers through the flues and down the passage by the direct action of the exhaust steam from the pipes J, which exhaust commingles with the products of combustion, becoming part and parcel thereof, aiding in the intensity of heat, round and round the continuous current, which receives small supplies of fresh air in jets from the pipe N, between each puff of the exhaust, which gives life to the fire, with a closed chimney, furnace, and ash pit. An additional pipe K, is fitted to one end or middle of the drying pipe, with a valve in it for the escape of a small portion of the exhaust steam into the atmosphere, should it exert too much force on the fire when running at the greatest speed. M, M, are conduits leading the products of combustion from the flues up the stack while the damper O is open and the fire is kindling and steam is raising, but when steam is up, the damper and ash pit closed, and the engine running, then the exhaust forces all down the stack beneath the grate, and up through the fire round and round, saving and burning all the heat, smoke, gas, and exhaust steam.

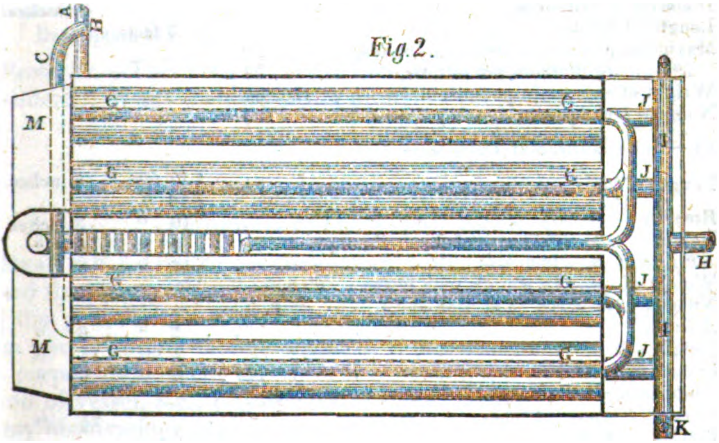
Fig. 2.

And the size of new boilers to which these improvements are to be attached, may be reduced, at least one-third, as the whole boiler may be enveloped in the furnace, except a small dome or drum to take dry steam from.

For the Journal of the Franklin Institute.

Particulars of the Steam Propeller Sovereign.

Hull and Machinery built by Messrs. Launi & Co., Glasgow. Intended service, Black Sea.

HULL.—

Length on deck from fore part of stem to after part of stern post, above the spar deck,		196 feet	9½ inches.
Breadth of beam at midship section—*molded*,		24 "	10 "
Depth of hold,		18 "	1 "
Length of engine and boiler space,		45 "	3 "
Draft of water at load line,		11 "	
" " below pressure and revolutions—*average*,		10 "	6 "
Tonnage, Hull,	379 } (Eng.) 602		
" Engine Room,	223		
Contents of bunkers in tons of coal,	120		
Masts and rig,	Brig.		
Weight of hull, (iron) 448,000(wood, &c.)336,000 lbs.			

ENGINES.—Angular Geared.—

Diameter of cylinders,			40 inches.
Length of Stroke,		3 feet.	
Maximum pressure of steam in pounds,	15		
" revolutions per minute,	38		
Weight of engines in pounds,	156,800		
Nominal horse power,	100		

BOILER.—One—Horizontal Tubular.—

Length of boiler,		{ 17 feet 16 "	6 inches.
Breadth "		10 "	3 inches.
Height " exclusive of steam chimney,		9 "	6 "
" " inclusive "		14 "	6 "
Weight of " in pounds with water,	67,200		
Number of furnaces (3 at each end,)	6.		
Breadth "		2 "	8 "
Height "		2 "	11 "
Length of grate bars,		6 "	6 "
Number of tubes of brass,	456.		
Internal diameter of tubes,			2⅞ "
Length of tubes,		6 feet.	
Diameter of smoke pipe,		3 "	6 "
Height "		24 "	
Description of coal,	Bituminous.		
Consumption per hour,	1650 lbs.		

PROPELLERS.—

Diameter of screw,		11 feet	6 inches.
Pitch of screw,		11 "	6 "
Number of blades,	2.		

Remarks.—Frames *shape and dimension*, L 4 by 3 by $\frac{7}{16}$; *distance apart at centres*, 18 ins. Plates, *thickness*, ⅝-to ⅜-ins., and 16 strokes from keel to gunwale. Launching draft, with all machinery on board, (average) 8 feet 5 ins. Displacement, 450 tons—stem, 6 by 2 ins.—stern post, 6 by 4 ins. H.

For the Journal of the Franklin Institute.

Particulars of the Steam Propeller Candia.

Hull built by J. C. Mase & Co., Machinery by G. Rennie & Co. Intended service, Southampton to Alexandria.

Hull.—		
Length on deck from fore part of stem to after part of stern post above spar deck,		281 feet.
Breadth of beam at midship section above the main wales—*molded*,		40 "
Depth of hold,		29 " 6¾ inches.
Draft of water below pressure and revolutions (mean)		18 " 7 "
Tonnage,	2200. Eng.	
Displacement of Hull,	2520 tons.	
Engines.—Two—Geared Trunk.—		
Diameter of cylinder, mean		70⅜ inches.
Length of stroke,		4 feet.
Maximum pressure of steam in pounds,	21.	
" revolutions per minute,	36½.	
" speed,	12.	
Horse power nominal,	450.	
Indicated "	1356.	
Boilers—		
Description of coal,	Bituminous.	

Remarks.—This vessel is considered to give the best result, all things considered, of any English steam propeller yet built. H.

For the Journal of the Franklin Institute.

Particulars of the Steamer Ericsson.[*]

DEAR SIR.—Having, in compliance with your request, embarked on board the *Steamer Ericsson* on the 28th inst. for the purpose of witnessing the performance of her machinery, and having received authority from you to control the operations of it in such a manner as I saw fit for the purpose of advising myself of the consumption of fuel in her furnaces, speed of vessel, &c., I have now to submit to you the following report of my observations, and for the purpose of ready comparison and estimate of the value of the elements submitted, I give the following particulars of hull and machinery.

HULL.—Length on deck, 250 feet; breadth of beam, 40 feet; depth of hold, 27 feet.

Draft of Water.—Forward, 17 feet 2 inches; aft, 16 feet 10 inches; (mean 17 feet.) Coal and water on board, 550 tons; area of immersed midship section at this draft, 546 square feet.

MACHINERY.—Two inclined engines of direct action.

CYLINDERS.—62 inches in diameter by 7 feet 8 inches stroke of piston.

[*] Originally communicated to the New York Tribune.

Water Wheels.—32 feet in diameter by 10 feet in width.

Boilers.—Two vertical tubular—supplied by fresh water from the external condensation of the steam. Natural draft to furnaces.

Cut-off.—Drop valve, with adjustable arrangement, set in this experiment at $\frac{45}{100}$ths of stroke of piston.

Dip of Water Wheel Blades.—4 feet 6 inches.

Coal.—Anthracite, Pittston.—Bituminous, Cumberland.

Results of Experiments.

1. *Anthracite.*—At sea, May 28th, 1·45 P. M. to 2·16 A. M. 29th, 12 hours and 30 minutes—consumed 26,400 lbs.=2112 lbs. per hour, or ·94 of a ton (of 2240 lbs.) per hour.

2. *Bituminous.*—At sea, May 29th, 2·15 to 11·30 A. M., 9 hours and 15 minutes—consumed 15,390 lbs.=1664 lbs. per hour, or ·74 of a ton per hour.

3. *Anthracite.*—At sea May 29th, 11·30 A. M. to 1·45 P. M., 2 hours and 15 minutes—consumed 4320 lbs.=1920 lbs. per hour, or ·85 of a ton per hour.

Recapitulation.

1st.	12	hours	30	minutes	× 2112	lbs.	=	26,400 lbs.
2d.	9	"	15	"	× 1664	"	=	15,392 "
3d.	2	"	15	"	× 1920	"	=	4,320 "
	24		00					46,112 lbs.

the total consumption for 24 hours = 20·58 tons.

The average pressure of the steam was 22$\frac{5}{8}$ths lbs. per square inch; the vacuum 27$\frac{1}{2}$ inches; and the average revolutions of the engines, 13$\frac{7}{8}$ths per minute.

The speed of the vessel as measured by a chip log with 25 fathoms of stray line, was 11 knots, large, = 12·83 statute miles per hour.

The fresh water condensers, maintained an uniform vacuum of 27$\frac{1}{2}$ inches of a mercurial column, and, by aid of an auxiliary distilling vessel, more water was readily obtained than was required to meet the loss by vents and leaks from the boilers, pipes, &c., &c.

With a view to test the evaporative qualities of the boilers and at the same time to verify the extraordinary results here given in economy of combustion, the water of condensation therefrom, was at six different periods, measured in a vessel, and the supply was found to reach the unexampled quantity of 9·96 lbs. per pound of anthracite coal consumed, and notwithstanding this unprecedented attainment in a marine engine, it could have been very materially increased with better firing of the furnaces.

In conclusion, it may not be amiss for me to add, that all the elements of means and results here given, were noted by myself, so far as it was practicable for me to do so, and such as I had to transfer to the observations of others, were alone confided to my two assistants, who accompanied me on this occasion for such service.

I am, respectfully, yours, &c.,

Chas. H. Haswell.

John B. Kitching, Esq., New York.

Remarks by Committee on Publication.

The economy of fuel adverted to in the preceding statement may be readily accounted for, and, in our judgment, is *not* extraordinary when the circumstances of the case are considered. It is due to two causes: 1st, To the large amount of grate and heating surface per pound of fuel used. 2d, To the use of a surface condenser, (in which the "*Ericsson*" is not peculiar.) Supposing the data correct,* the results are certainly good; but when 7000 feet of heating surface are employed to evaporate 311 cubic feet, or 19,400 pounds of water per hour, we believe that other steamers will compare with the "*Ericsson*," on at least equal terms in point of economy. The really extraordinary feature of the trial is, that so little water was evaporated with so much boiler surface.

M.

Steam as an Industrial Agent.†

Mr. William Fairbairn, whose great services in developing mechanical science can never be overlooked or forgotten in any quarter of the world where mechanical talent possesses rank at all, has just given one more proof of his attention to the exigencies of the times, by delivering two elaborate lectures at the Manchester Mechanics' Institution, on "Steam, its Properties and Application to the Useful and Industrial Arts." In that great centre of steam power, such a subject, commented upon by such an authority, and coming, too, in the wake of the movement there making to secure a better system of steam superintendence, was certain of meeting with more than ordinary attention; and we are glad to find that the lecturer's efforts were duly appreciated by the large audiences assembled to meet him. In that portion of his discourse which related to boilers, he stated that the cylindrical or spherical was the most eligible and the strongest form in which iron plates would resist internal pressure. The deduction for loss of strength, on account of riveted joints and the position of the plates, was about 30 per cent. for the double riveted joints, and 44 per cent. for the single ones; the strengths (calling the plates 100) being in the ratio of 100, 70, and 56. He found that 34,000 lbs. to the square inch was the ultimate strength of boilers having their joints crossed and soundly riveted. Flat surfaces, frequently essential, were not so objectionable with respect to strength as they appeared to be at first sight, but when properly stayed, were the strongest part of the construction. This was proved by the result of experiments made on the occasion of the bursting of a boiler at Longsight. Two thin boxes, 22 inches square and 3 inches deep, were constructed. One corresponded in every respect to the sides of the fire-box of the exploded boiler, the stays being in squares,

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* **Exception must be taken in this connexion, to the manner of ascertaining the amount of water evaporated. Why were not indicator cards taken and the results calculated, as is the *universal* custom in such experiments? Short trials of the amounts of water drawn from the condenser in a given time, form an entirely novel method of getting at this datum; and where the quantities delivered vary at different times cannot be so conclusive as the ordinary method, which excludes all possibility of error.**

† **From the Lond. Pract. Mechanics' Journ., April, 1855.**

5 inches asunder, and the side containing 16 squares of 25 inches area. The other contained 25 squares of 16 inches area, the stays being 4 inches asunder. One side of both boxes was a copper plate ½-inch thick; and the other side of both an iron plate three-eighths inch thick. To these the same valve, lever, and weight were attached, and the pumps of an hydraulic press applied. That divided into squares of 25 inches area, swelled ·03-inch with the eighth experiment, at a pressure of 455 lbs. to the square inch. At the nineteenth experiment, with a pressure of 785 lbs. to the square inch, the sides swelled ·08-inch; and at a pressure of 815 lbs. the box burst by the drawing of the head of one of the stays through the copper, which, from its ductility, offered less resistance to pressure in that part where the stay was inserted. The tenth experiment, with the other box of 16 inch areas, resulted in a swelling of ·04-inch, the pressure being 515 lbs. to the square inch. At 965 lbs. the swelling was ·08-inch, and from that point up to 1265 lbs. the bulging was inappreciable. With the forty-seventh experiment, at a pressure of 1625 lbs., one of the stays was drawn through the iron plate, after sustaining the pressure upwards of 1½ minutes, the swelling at 1595 lbs. having been ·34-inch. The first series of experiments proved the superior strength of the flat surfaces of a locomotive fire-box, as compared with the top or even the cylindrical part of the boiler. The latter evidenced an enormous resisting power, much greater than could be attained in any other part of the boiler, however good the construction; and they showed that the weakest part of the box was not in the copper but in the iron plates; which gave way by stripping or tearing asunder the threads or screws in part of the iron plate. According to the mathematical theory, the strength of the second plate would have been 1273 lbs.; but it sustained 1625 lbs., showing an excess of one-fourth above that indicated by the law, and that strength decreased in a higher ratio than the increase of space between the stays. The experiments show a close analogy as respects the strengths of the stays when screwed into the plates, whether of copper or iron; and riveting added nearly 14 per cent. to the strength which the simple screw afforded. These experiments were conducted at a temperature not exceeding 50° Fahrenheit. His experiments on the effects of temperature on cast iron, did not indicate much loss of strength up to a temperature of 600°; and he concluded that the resisting stays and plates of locomotive boilers were not seriously affected by the increased temperature to which they were subjected in a regular course of working. At the termination of the second lecture, Messrs. E. T. Bellhouse, Fenton, and Kay, severally explained a set of models and drawings of safety valves. Mr. Bellhouse directed the attention of the audience to Cowburn's "oscillating safety valve," as illustrated by us last month; he also explained some diagrams of vacuum and float valves, the joint invention of himself and Mr. Cowburn. Mr. Fenton's valve was shown to be composed of two globular valves under the same lever; at one end of the lever is an adjustable spiral spring, which when set, can be covered up and locked, so as not to be interfered with; the other end of the lever has an ordinary spring balance. The peculiarity of this valve is, that if a greater weight be put on the exposed end of the lever, the one ball valve becomes the fulcrum, and causes the other valve to be raised, and allows of the exit of steam at a

lower pressure than the spiral spring is set to. Mr. Kay's valve is on the piston principle, so arranged as to afford a large area for the emission of steam.

Important Improvement on the Electric Telegraph.*

A discovery is said to have been recently made at Stockholm, which, if it can be realized and practically applied, will tend greatly to facilitate telegraphic communications. The discovery to which we allude is the means of transmitting two messages at the same time along a single wire.

It is evident that if at the same instant a message is sent along a wire in one direction, another message could be speeding its way through the same wire in the opposite course, one-half the number of wires would be sufficient, and there would consequently be a great saving in the cost of forming new telegraph lines, and that those already laid down would be enabled to transact double the amount of business they are now capable of doing. To those who are not acquainted with the modes of transmitting electric telegraph signals, it may appear at first sight impossible to send messages in opposite directions at the same time along a single wire, as one current of electricity, it might be supposed, must necessarily clash with and counteract the transmission of another current in the opposite direction. But, in point of fact, not two only, but hundreds of electric currents in different directions are frequently passing through the same medium, without the slightest interference. The difficulty to be overcome is altogether of a practical kind, and that it does not arise from any limited capacity in the wire may be shown by the actual practice in existing telegraphs.

In the early days of the electric telegraph, before the conducting power of the earth was well known, a single wire only was employed for the return current, though several were required to transmit messages, and through that single wire different currents were often passing at the same instant. When the conducting power of the earth was applied to complete one-half the circuit, the moist ground became the transmitter of currents from every electric telegraph that was established, and through that medium there are now passing messages of all kinds, which, though mingled together in mother earth, become separated at the poles of their respective voltaic batteries, and are delivered without any interference with one another. Thus in constructing a telegraphic line, a wire insulated from connexion with the ground, by being supported on posts, is extended between the towns to be placed in communication, and at each end the wire is connected with a copper plate buried in the earth, to complete the voltaic circuit. These plates of copper, technically called "earth plates," or more commonly "earths," conduct the electricity from one to the other through the moisture of the earth much more readily than any artificial metallic conductors that could be laid down; the resistance thus offered to the transmission of electricity being so small as to be scarcely appreciable. These earth connexions are so convenient that they have been formed at all the stations where telegraphs have been established, which are thus voltaically connected together. Suppose, for instance, that the zinc end of a voltaic battery is connected with the earth, and that the copper end is connected with a needle instrument in London, and that that is connected with the telegraph wire supported on posts and extended to Edinburgh, where, after passing through a corresponding instrument, it is connected with a metal plate buried in the ground. The electric current will then pass through the instrument in London, along the wire to Edinburgh, where it will deflect the needle, and passing on to "earth," will there come into instantaneous connexion with the zinc end of the battery from which the current emanated, and will return to that battery regardless of all interposing electric currents that may be passing through the earth at the same time. A slight knowledge of the nature of a voltaic battery will be sufficient to prove that it could not be otherwise. No excitement of voltaic electricity can take place unless there be a connexion between the two poles of the battery. So long, therefore, as the wire at Edinburgh continues detached from the earth plate, the battery in London remains inactive, provided the wire be perfectly insulated. It is by the act of bringing the two poles into connexion by means of the wire and earth plate at Edinburgh that the electricity is excited, and the current is sent in that direction alone. The action of all other batteries that may be connected with the earth, cannot affect the electric current thus established between London and Edinburgh, because they do not contribute in any way to complete the circuit by which alone the electricity is at once excited and transmitted. A metallic conductor, in the same manner, will connect the opposite poles of any number of batteries, and will thus serve to transmit several different electric currents without their interfering. It would not be difficult, indeed, to make a single wire form part of the circuits of one hundred different batteries, each one of which might be transmitting distinct telegraphic messages.

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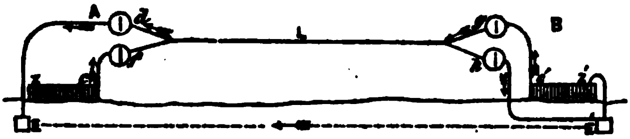
*From the Lond. Civ. Eng. and Archt. Journ., May, 1855.

From this consideration of the facility with which a single wire can conduct different electric currents, it might be supposed that there would be no difficulty in completing such an arrangement as is now said to have been effected in Sweden, and that one wire might be made to serve the purpose of the thirteen that are supported on posts near London, in addition to others that are buried underground. It is nevertheless one of those things which, though often attempted, has not yet been practically accomplished; nor do the accounts of the discovery by Prof. Edlund, of Stockholm, represent him to have done more than send two currents along the same wire, and those in opposite directions. The great difficulty to be overcome in endeavoring to effect such an arrangement is, to prevent the electric current from the transmitting battery, from making a short circuit through the adjoining instrument, instead of traversing the wire to the corresponding instrument at the distant station. The accompanying diagram will serve to show the direction which the electric current would take, if there were no special provision to break contact with the near instrument.

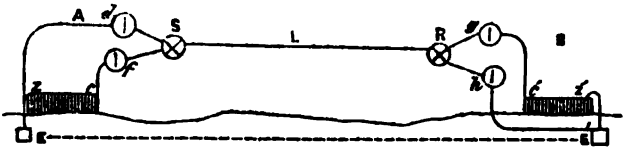
Let *d*, *f*, fig 1, represent two telegraph instruments at the station A, the upper one of which, *d*, is intended to receive messages transmitted from the instrument *g*, at the station B; and the lower one, *f*, is the instrument connected with the voltaic battery *c z*, from which messages are to be transmitted to *h*, along the line wire L, to the earth plate E′, and through the earth, back to the battery. It will be perceived, however, that as the instrument *d*, is also connected with the line-wire, and with the earth plate E, that a short passage is open for the transmission of electricity from *c* to *z*, in the direction of the arrows, without traversing the line-wire, consequently there would be no electric current sent to the instrument *h*. The same effect would attend the arrangement at B, where a short circuit would be also established through the second instrument, and no communication could be made between the distant stations. If, again, it were attempted to send several messages along a single wire in the same direction, by having separate batteries and instruments, the electric currents might be transmitted to the distant instruments, but they would pass through all of them indiscriminately, producing an incomprehensible medley of signals. The problem then to be solved is, to make an arrangement by means of which the electric current from the battery at A, may be sent along the line-wire, without being diverted through the instrument *d*, and yet at the same time to maintain such a connexion between the instrument *d*, and the line-wire, and the earth, that it may be always in a state to indicate the signals that may be transmitted to it from the corresponding station.

Fig. 1.



No description has yet been received of the mode by which Prof. Edlund proposes to overcome the difficulty, but we can fully understand the principle on which such an arrangement may be made, and we may venture to point out the means by which it might be successfully accomplished. Supposing the arrangement of the instruments and batteries to be the same as in the preceding diagram, let there be introduced at the points of junction with the line-wire, small instruments for making and breaking contact, R and S, fig. 2.

Fig. 2.



The cross-lines in the contact-wheels represent strips of metal inlaid in wood, and when in the position shown in the diagram, the instrument *h* would be connected with one end of the line-wire, and the instrument *f* would be connected with the other end, whilst the two instruments *d* and *g*, would be out of contact. Under these circumstances an electric current would pass from the battery at the station A, through *f*, to the instrument *h*, whence it would be transmitted to the earth, and by thus completing the circuit those two instruments might communicate with each other as perfectly as if there were no other instruments connected with the wire. If the wheels, R and S, make the eighth part of a revolution, the positions of the wires forming connexion with the instruments would be reversed, and then *f* and *h*, would be thrown out of contact, and the current would be transmitted from the voltaic battery at B, through *g* and *d*, and those two instruments would be able to communicate. It is evident, if the two contact-wheels could be made to rotate exactly together, that independent signals might be transmitted through at least two instruments at the same station at the same time, through a single wire. The synchronous movement of two instruments at distant stations has been accomplished in Mr. Bakewell's copying telegraph; therefore, it is quite possible to effect such an arrangement as the one we have indicated.

But it may be said that this would not solve the problem, because not more than one electric current would be transmitted along the wire at the same instant. The currents would indeed be transmitted alternately, but for practical purposes the effect would be the same as if they were passing at the same instant, for the alternations might be made so quickly as to appear to be continuous, and to answer the same purpose as if they were. Suppose, for example, the wheels, R and S, to be rotating ten times in a second, then as contact would be made and broken four times each revolution, the corresponding instruments might be placed in connexion with each other forty times in a second. The greatest number of beats by the needle telegraph during the rapid transmission of a message does not exceed five per second; therefore, with a much smaller number of alternations than we have supposed, each instrument might be simultaneously sending and receiving messages along the same wire; nor need the number be limited to two instruments and two different stations. It might be possible to arrange on the same principle many instruments connected with others at several stations, and thus all the telegraph communications of an extended line might be maintained with one or two wires, and each station might have a separate means of communication independent of the other stations beyond it, with which it would not interfere, and from which it would be just as distinct as if separate wires were laid down to each station. For the purpose of sending messages in opposite directions by the same wire between only two communicating stations, it would not indeed be necessary that the contact-wheels should rotate synchronously. If one of them was rotating rather faster than the other, the number of times that connexion would be made and broken with the corresponding instruments during a second would be so great, compared with the number of signals transmitted, that the electric current would not be perceptibly interrupted during the transmission of a message. It would indeed be far better that a synchronous movement of the wheels should be arranged, which we believe might be effected at any number of stations along an extended line of communication by means of an additional wire, for then not only could messages be sent and received at two stations at the same time by one transmitting wire, but several instruments at all the stations might be receiving and transmitting messages with that same wire. By this means two wires might serve the purpose of many, and as those only would be required they might be made thicker and be more carefully insulated than is economically practicable when many are wanted for doing the same amount of business; and thus telegraphic communications might be rendered more free from the interruptions caused by imperfect insulation and by accidents to the wires, as well as much cheaper.

Whether the arrangement we have suggested be similar to that which is said to have been successfully made by Prof. Edlund we have no present means of knowing. We wish to show that such a plan is practicable, and that it might even be extended far beyond the limits to which the accounts yet published state that it has been carried.

*Correction of the Compass in Iron Ships.**

I have read with great interest the reports of the discussion on the correction of the compass in iron ships at the late meeting of the British Association,—and I regret much that it was out of my power to be present and to take part in the discussion. Perhaps I may be allowed to remedy this omission by the insertion of some remarks in the columns of the *Athenæum*. I am the more anxious to do this, because the circumstance that a distinguished philosopher, of indisputable competency and impartial character, has now fairly considered the question, places it in a position totally different from any which it has occupied before. I have deep satisfaction in remarking, that the great principles upon which I founded the method of correcting the compass, are entirely recognised by Dr. Scoresby, and even that some minor modifications of those principles (which, as will appear in the remarks below, I had anticipated as probable,) have now been established by Dr. Scoresby's beautiful experiments. In the estimation of the actual extent and rapidity of the changes produced by these modifications, I may perhaps differ in some measure from Dr. Scoresby; and I may be disposed to recommend a practical course, slightly different from that which he would propose. Still, I am happy to find that upon the fundamental points of the theory, we are in complete accordance.

I. It may perhaps be advantageous to give a few steps of the history of this subject. The law, that the greater part of the disturbance of the compass, produced by an iron ship, depends upon its *polar* and not upon its *induced* magnetism (in the ordinary sense of the word, *induced*), was established by me in a paper printed in the "*Philosophical Transactions*" for 1839. The experiments themselves had been made in 1838. In page 212 I observe—"The most remarkable result, in a scientific view, from the experiments detailed above, is the great intensity of the permanent magnetism of the malleable iron of which the ship is composed. It appears, however, that almost every plate of rolled iron, is intensely magnetic." (It is to be noted that I used the term *permanent* magnetism as equivalent to *polar* magnetism.) I then allude to experiments on the magnetism of plates of wrought iron; and these experiments were the last with which I had any acquaintance until I saw some of Dr. Scoresby's beautiful illustrations of the change of magnetism of iron plates. In page 213 I remark, "It seems sufficiently probable that the independent [polar] magnetism of the ship will change with time. This consideration enforces strongly the necessity of periodical examination as suggested above." This is all that was printed by me in reference to the change of the polar magnetism of ships and their occasional examination; but it is not the only instance in which I endeavored to bring them before the notice of the proper authorities. In 1839, July 20, I submitted a memorial to the Board of Admiralty on the advantage of a supervision, by the government, of the correction of the compass in iron ships; in which occur the following remarks:—"There is no reason for presuming that the magnetic state of the ship (especially in the case of steam ships) will remain invariable for many years; and there is reason for supposing that it will vary."—"Experiments of various kinds and in various localities should be made on the same ship, for ascertaining whether there is sensible change in different parts of the earth." And with regard to the magnets:—"The important results, lately arrived at by Mr. Scoresby, and wholly unknown to the persons commercially engaged in the fabrication of magnets, show that attention to those points on which the permanency of the magnetism depends, cannot be expected from common tradesmen." The Admiralty (I believe in accordance with precedent and with the rules of the department) declined to undertake the supervision for commercial ships; and, as no other iron ships then existed, this decision amounted practically to a refusal to enter on the matter. Had the subject been then taken up by the Government, it might perhaps have been advanced several years. I did myself endeavor to collect information, and I took notes of the position in which one ship was built; but the occupations of a laborious office compelled me to desist. I may mention, that in almost every instance reported to me, in which the correction failed after a time, I had reason to think that the failure arose from change, not in the ship, but in the correcting magnets; and this consideration, combined with the feeling of want of leisure, prevented the extension of my inquiries.

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* From the Lond. Athenæum, Oct. 28, 1854.

II. I am deeply struck with the beauty and the importance of Dr. Scoresby's experiments; and if I bring to notice the circumstance that the polar magnetism of iron plates and the possibility of change in the magnetism, were first strongly insisted on by myself, I trust it will not be understood that I mean to say that those experiments are unessential to our present knowledge of the subject. Still, as the first who examined into and speculated upon this subject, I claim the right of criticising the name which Dr. Scoresby has proposed; and I express my opinion that "retentive" ("retained" would be better in grammatical sense) does not exactly represent the characteristics of the magnetism of wrought iron plates. The latter appears to me to differ very little from the magnetism of hard steel bars. A steel bar is magnetised by induction (as in an iron plate)—a steel bar may have its magnetism weakened or reversed:

if immersed in the sea-water, it would probably lose its magnetism sooner than an iron ship would. But as in practice, the magnetism of an iron ship is *slightly* more liable to change than that of a steel magnet *very carefully* preserved, it may be desirable that a name expressive of that idea should be given to it. I would propose to call it, the "sub-permanent polar magnetism of wrought iron."

III. I think it likely that the striking character of Dr. Scoresby's experiments produces an impression of the extent of their applicability to iron ships far greater than is warranted by careful consideration. We may speak poetically of the shocks which a ship receives from the waves; but in reality, the plates of iron of which a ship is composed, sustain no such shocks. The direct effect of the most violent sea upon them is this: that in the course of two or three seconds of time, the plate is plunged five or six feet deeper in the water, and sustains the corresponding hydrostatic pressure. This is very different, indeed, from the raps or slaps in Dr. Scoresby's experiments, in which it is essential that the blow be of the nature of impact, occupying a very small fraction of a second of time. Probably the strain of extension to which the plates are subjected may produce a greater effect: on this, however, experiments are wanting. But even here, the change in the state of extension is not sudden, but gradual. The tremor produced by steam power is more likely to affect the plates in some parts of the ship. It is evident that there are causes in action tending to produce effects like those exhibited in Dr. Scoresby's experiments,—and it is equally evident that the action of those causes must be exceedingly slow. On one point, however, I trust that a consideration of Dr. Scoresby's experiments will disabuse many persons who have not been well acquainted with the nature of induction and sub-permanent magnetism. The change to be expected in a ship's sub-permanent magnetism in sailing from England to the Cape of Good Hope does *not* essentially depend on her passing into another magnetic hemisphere. It *does* depend mainly on this circumstance: that, supposing her to have been built with her head to the north, or in the line of boreal magnetism, she is then turned with her head to the south, or in the line of austral magnetism, and is so kept, exposed to slight tremors, for one or more months. If she had been moored off the coast of Portugal for the same time, in the same position, and exposed to the same tremors, I apprehend that her magnetism would have undergone nearly the same change (as regards horizontal deviation of the compass) as in the voyage to the Cape of Good Hope.

IV. I think the selection of the loss of the *Tayleur*, as the text for the principal discussion on iron ships, with all its attendant horrors (having no application whatever to the matter under discussion), was unfortunate. When the feelings are excited, the judgment of the speaker, as well as of the hearers, is very liable to be perverted. The question at issue is the very abstract one:—Is it likely that in two days the magnetism of a ship could be so much changed that the compass would be disturbed through an angle of two points? I unhesitatingly answer:—It is not likely; and, speaking with our present knowledge on the subject, it is not possible. I have already stated, that I conceive the causes pointed out by Dr. Scoresby, to be wholly inadequate to produce such a rapid change.

And I aver that there is no known instance of such a change; and I do not believe that an instance can be produced of a rapid change of one-fourth or one-tenth part of this amount. I believe that information on these matters is not wanting:—a single firm in Liverpool have "corrected" the compasses in several hundred iron ships, and they cannot fail to have received notification of any such changes as those mentioned above.

Before dismissing this subject, I will advert to two sources of error, not essential to my method of correcting the compass, but to which it may be liable if due care is not exercised. The first is, that captains are hardly aware that a very trifling disturbance in the position of the compass (for instance, a change of a quarter of an inch in the height), may very greatly disturb the neutralizing influence of the magnets. The second is, that the artists who correct the compasses, are too much inclined to place the correcting magnets in the position called "end-on." In this position, the magnet exerts greater deflective power, but it also introduces a force perpendicular to the ship's deck; and this force, when the ship heels, produces an uncorrected horizontal disturbance. While the building in iron was principally confined to paddle steam ships, this was not important; but now, when so many screw steam ships and sailing ships are built of iron, this arrangement ought never to be used. I know not whether the compasses of the *Tayleur* could have been affected by either of these causes.

V. The question, however, which immediately presses is, What (under all circumstances) is it best to do now? In answer, I assert in the first place, and I am supported in this by Dr. Scoresby's experiments, that the source of local disturbance and its laws are perfectly well known; that the disturbance can be neutralized by well known means to the greatest exactness; and that this neutralization is perfect during change of time and change of place, until the ship herself undergoes an organic change. In the next place, I protest strongly against the system, now in use (I believe) in the Royal Navy, of using a table of errors, and thus constantly making numerical corrections instead of once making a mechanical correction. (1.) It is baffling to the mariner. (2.) It is liable to exactly the same errors, in the event of a change in the ship's sub-permanent magnetism, as the system of relying on the mechanical correction. (3.) It is liable to errors peculiar to itself, which would be entirely avoided by the use of mechanical correction. In illustration of the last remark, I will refer to the table in page 104 of the late Capt. Johnson's book on the "Deviations of the Compass," second edition, a work, in many respects, highly valuable. Captain Johnson has given the observed deviations of the compass on board three iron steam vessels in different parts of the world, and I select the last, (the *Trident*) because its deviations were the largest. The deviations in the Thames ranged from 22° 15′ E. to 21° 12′ W. The deviations of the same compass at Malta ranged from 15° 29′ E. to 14° 21′ W. Now the proportion of the terrestrial horizontal magnetic forces in the Thames and at Malta is, as 52 to 75 very nearly. Therefore, if the ship's sub-permanent magnetism remained unaltered, the tangents of the angles of deviation in the Thames and at Malta would have been in the proportion of 75 to 52.

On computing the Malta deviations from those in the Thames by this proportion, we obtain 15° 50′ and 15° 3′; agreeing with those observed more nearly than observations can be made with a ship's compass. The whole of the deviations, recorded by Capt. Johnson for the *Bloodhound*, the *Jackal*, and the *Trident*, at Lisbon, Constantinople, the Piræus, and Malta, can be computed in the same way from those in England, and the results are equally accordant. (The terrestrial horizontal forces on the same scale of proportion are, Lisbon 60, Constantinople 77, Piræus 76.) It follows from this, that the ship's sub-permanent magnetism in each case was unaltered, and its effect would have been exactly compensated at every locality by a permanent magnet. And thus the captain of the *Trident*, using Captain Johnson's table, would have had errors of nearly seven degrees; whereas, if he had used my correcting magnets, he would have had no perceptible error in the whole voyage. I pointed out this result to Captain Johnson: I know not with what effect. (4.) In extreme cases it cannot be used at all: thus, in the Greenland seas the compasses would sometimes turn round with the ship: whereas, there are in the Greenland seas several iron ships with my correcting magnets, effecting their purpose (I am informed) successfully. (5.) In cases not so extreme, the inconvenience is intolerable; thus, in one instance which came under my own eyes, the compass changed 100 degrees with a very small motion of the ship; and the directive intensity in one position was only one-tenth of what it was in another position; these inconveniences are entirely remedied by my correcting magnets.

On considering the whole matter, I am led to give the following as my opinion:—For voyages of moderate duration, as, for instance, not further than to the Mediterranean or to the northern parts of North America, I do not think that any improvement can be made in the existing system except in details, to which I have alluded. The "end-on" position of the magnets ought to be forbidden; and some attention ought to be given to the ship's sub-permanent magnetism in the direction perpendicular to the deck. For voyages of greater duration, as to the Plata, the Cape of Good Hope, &c., I think it desirable that means should be provided for enabling the captain to make the small changes which may be required in the correcting magnets. I am confident, that I can point out a practical course by which this can be effected; and I am satisfied that, with the sanction of one liberal ship-owner, the aid of one intelligent captain, and the command of one ship for a few days, I can arrange every thing with good hope of complete success.

It might, I think, be advantageous that some general supervision should be exercised by the Board of Trade over the correction of the compasses in iron ships; and at no preceding time could reliance be more implicitly placed on the friendly intentions and judicious aid of that Board than at present. It might also be advantageous that the Marine Board of Liverpool should, as a body, interest themselves in the matter. Whatever course may seem best, I shall be happy to give any assistance in my power.

VI. The remarks above are intended by me to apply only to iron built ships, in which the sensible part of the disturbance of the compass is produced almost entirely by the ships' sub-permanent magnetism. In wood-built ships, in which the induced magnetism is the principal disturbing power, the rules of correction are necessarily different. On these, at present, I have only to make the same general remark which I have made above; that I disapprove of the use of a table of errors, and that I prefer the use of mechanical corrections; the nature of which, as applicable to the neutralization of induced magnetism, is perfectly understood. G. B. Airy.

Royal Observatory, Greenwich, October 17.

(To be Continued.)

*On an Improved Wrought Iron Piston.** By Mr. James E. M'Connell.

This piston is constructed entirely of wrought iron, and it is forged in one piece with the piston-rod, by means of which the ordinary joint between the piston and piston-rod is avoided, and a great saving of weight is effected.

The construction is shown by the drawings, which represent an 18-inch piston for a locomotive engine.

Fig. 1 is a transverse section of the piston;

Fig. 2, a side view of the cover, detached from the piston;

Fig. 3, a sectional plan, showing the interior.

The body of the piston, A A, is a circular disk of wrought iron, which is forged under the steam-hammer, with a portion of the piston-rod, B, formed upon it, about 9 inches long, to which the piston-rod is afterwards welded. The circular ring, C C, is also raised upon the disk in the forging, thus completing the body of the piston in one solid piece of wrought iron.

Fig. 1.—Section.

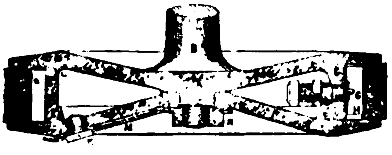


Fig 2.—Elevation of Cover.

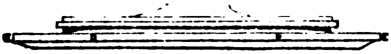


Fig. 4.

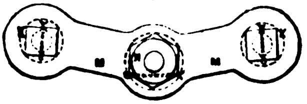
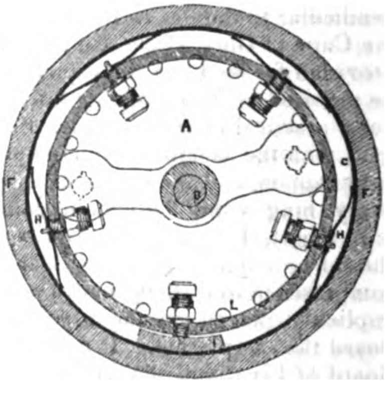


Fig. 3.—Plan.



The wrought iron cover, D D, is screwed into the ring, C C, by a single thread cut upon the projecting rim, E E, on the inner side of the cover, as shown in the detached view of the cover, Fig. 2.

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*From the London Artisan, March, 1855.

The cover is dished in the centre as well as the body of the piston, so that the two sides meet in the centre, to diminish the weight of material.

The packing consists of two plain brass rings, F F, lined with a thin steel hoop, G, which fit into a shallow recess on the inside of the brass rings. The four steel springs, H H, are set out against the packing by set screws fixed in the ring of the piston, C C. The fifth set screw is attached to a solid block, I, which is placed at the bottom of the piston, and serves to support the weight of the piston, to prevent it from fluting the cylinder.

Two holes, K K, are provided in the cover for the purpose of unscrewing it, by means of a bar passed through either hole, K, and bearing at the point in a series of holes, L L, sunk in the opposite side of the piston. The holes, K K, are closed by brass screwed plugs, which are kept from turning by a thin brass plate, M, fixed by split pins, as shown in the detached plan, Fig. 4. This plate also secures the brass locking-nut. N, for preventing the cylinder cover from unscrewing: the thread of this nut is right-handed, whilst the main thread of the cover is left-handed.

The weight of this piston, including the piston-rod, is 217 lbs. for the size shown, 18 inches diameter, which is 89 lbs. lighter than the ordinary construction of pistons of the same size, weighing 306 lbs. The weight of a 16-inch wrought iron piston and rod is 160 lbs., being 47 lbs. lighter than the ordinary construction.

This saving of weight amounts to 178 lbs. in the pair of 18-inch pistons, and 94 lbs. in the 16-inch pistons, which is a point of considerable importance at the high speed of 600 to 800 feet per minute, at which locomotive engine pistons are driven; the consequent reduction of momentum adding to the durability of the working parts by reducing the strain upon them, as well as diminishing the disturbing effect upon the motion of the engine.

The solid construction of this piston avoids all risk of accident from the piston working loose upon the rod, which in the ordinary construction is liable to cause the fracture of the cylinder-covers, and sometimes more extensive injury.

There are upwards of 200 of these pistons now in use, and some of them have been at work for two years. The lightness of the piston, and the accuracy of adjustment maintained throughout, in consequence of the absence of joints and loose parts in the construction, allow the brass packing-rings to be worn down to a greater extent than usual before requiring renewal. These rings, of which specimens are exhibited to the meeting, have been worn down to ⅛th inch from the original thickness, ¾ths inch, and lasted twelve months in constant work.

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Mr. M'Connell exhibited one of the pistons, 18 inches diameter, and showed the process of taking off the cover, and screwing it on again; also specimens of brass packing-rings that had been worn down.

The Chairman remarked that there was great ingenuity and compactness in the construction of the piston, and the saving in the moving weight was very considerable, and was a point of importance, as well as the avoidance of a joint between the piston and piston-rod.

Mr. M'Connell said the object had been to obtain a piston constructed entirely of the toughest and strongest material, wrought iron, as light as possible, and in as few parts as possible: the piston and rod, indeed, consisted of only two separate parts besides the packing rings and springs; the cylinder was also shortened and made lighter by the piston being thinner. The greater accuracy of adjustment allowed the packing rings to be worn down thinner than usual; those shown had been worn down to ⅛th inch from ¾ths inch thickness, in about nine months' work.

Mr. Chellingworth observed that one of the rings had been worn somewhat unequally, being nearly ⅛th inch difference in thickness at the two ends.

Mr. M'Connell said the variation had probably been caused by a little difference in the pressure of two adjoining springs, arising from their not being adjusted quite equally: the rings had generally been found to wear down uniformly.

The Chairman inquired whether any difference had been found in the amount of wearing the cylinders oval?

Mr. M'Connell said the difference had not been noted, but there would be a less effect in disturbing the form of the cylinder, from the piston being one-third lighter than ordinary pistons, as the wear was caused only by the weight lying on one side.

The Chairman asked whether any disadvantage had been found from rusting of the iron in the interior, the piston being all made of wrought iron; and whether it had been tried in any stationary engines?

Mr. M'Connell replied that the joint of the cover, where it was screwed in, fitted so well that water could not get in; and the water being prevented from entering the piston, preserved the interior from rusting. The piston had only been tried at present in locomotive engines, and the construction was most applicable to small quick-moving pistons.

The Chairman proposed a vote of thanks to Mr. M'Connell, which was passed.—*Proceed. of Mechan. Engineers.*

For the Journal of the Franklin Institute.

Some Experiments upon Coffee as a Beverage. By Augustus T. Dalson and Charles M. Wetherill, Ph. D., M. D.

There are two great classes of beverages in use among all nations of men, whether the most civilized or the most savage. One of these classes is alcoholic, the other may be called, for brevity, the nitrogenized. Physiologists are pretty generally agreed, that the nitrogenized articles of food are especially effective by their union with oxygen in the body in keeping up the supply of animal heat important to life, and that if such food be liquid so as to be more quickly absorbed, it will effect its result more speedily. The South American Indians ferment their maize, reducing it to pulp by mastication; the Pacific Islanders prepare their *arva* from a root in a similar manner; the Tartars, Arabs and Turks ferment and distil the milk of mares and cows, and among the more civilized nations, those of warm climates employ mild wines, while those of cold countries prepare a stronger alcoholic drink by distillation. In general, the colder the climate the stronger is the drink and more deplorable is the consequence of its abuse. Whether this craving for alcohol in some form or other be an instinct implanted in our nature or not, and if so, whether it be not wiser to direct rather than to attempt to eradicate it, are questions which are at present about being investigated experimentally on a large scale in our country, and whatever be the result, are deeply interesting, not only from a moral but from a psychological point of view. The other class of beverages, containing nitrogen, is one, the use of which is as widely spread as the former. Nitrogenized food is supposed effective to replace the substance of the different organs of the body, gradually wasted away by the processes of vitality.

That which is the subject of this article, *coffee*, although at its introduction, violently opposed and subjected to prohibitory laws, is at present regarded as a boon to humanity, and is cultivated to the extent of six hundred millions of pounds weight[*]

Besides the tannin in the coffee, and which is somewhat altered during the process of roasting, the berry is characterized by two substances; one, nitrogenized, *caffeine*, which is contained in the proportion of about one per cent. (the same exists in nearly a double proportion in tea,) and is not altered by the roasting process, and the other a peculiar volatile oil developed during the roasting, existing in an extremely minute quantity,[†] and to which coffee owes its delicious flavor. Dr. Julius Lehman (*Liebig's Annalen* LXXXVII, 205) has investigated the effects of these two substances upon the system, and has shown that coffee retards the waste of the tissues of the body, and that consequently its use diminishes the amount of food necessary to preserve life. This effect he ascribes to the latter. These two acting to excite to greater activity the nervous and vascular systems, give to the wearied mind a greater elasticity and stimulate it to increased reflection. The increased activity of the heart, (and headache, &c., when taken to excess) are caused by the caffeine, and the increased action of the kidneys, the sudoriparous glands, and the intestines, together with the restlessness and congestion caused by an excess, he ascribes to the volatile oil. These effects were studied by Lehman by analysis of the excretory products of a person in a normal condition, and while under the influence of the above substances, and the conclusion is confirmed by deductions from observations made upon the effect of coffee upon the poorer classes of people whose nourishment is necessarily restricted. Much of the *nutritive* portion of coffee, namely, that contained in the legumine of the berry, is lost by the European method of making coffee, but the caffeine, contains nearly 29 per cent. of nitrogen, and Payen has calculated that a quart of *café au lait*, contains six times more nitrogen than an equal measure of flesh broth. Liebig has called attention to the fact that 140 milligrammes of caffeine correspond to 31 of gall in the form of taurine, and that if a decoction of coffee or tea contains only 0·05 centigrammes of caffeine, it must produce an appreciable effect, if this substance conduces to the formation of bile, which seems probable from its beneficial effect in certain diseases and in treatment for poisonings.

In this country a really good cup of coffee is perhaps rather the exception than the rule, and this may probably be attributable to the nation from which we are in the habit of selecting our cooks, since there is nothing in the whole culinary art which requires more "*sense*" than the preparation of good coffee. One of us has been in the daily habit for several years past, of preparing his own coffee (burning it himself,) and to the other, good coffee is not only a luxury but a necessity; we undertook the following experiments, therefore, with a view to ascertain whether a portable coffee, so simple in its preparation that it could not be spoiled, could not be offered to the public at a price at least as low as that for which the raw or roasted material may be purchased. This was only to be hoped for by extracting from the berry a larger amount of its nutritive substance than is done in the household, and in such proportion as would pay the expense of the operations to which it must be subjected. Our efforts in this respect have been in vain, but we are notwithstanding inclined to publish the experiments for the benefit of those who may wish to pursue the matter further than we did, and we hope with more success.

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[*] Lehman,

[†] One in 50,000, Johnson.

The coffee used in these experiments was the Mocha, and was taken from a bag which a year's trial had proved to give an infusion of a very delicate and pleasant flavor.

As a preliminary experiment, 65 grammes were exposed to a gradually increasing temperature in a retort in a wax-bath, a thermometer being thrust through the coffee in the retort and another being in the wax. The following are the temperatures at which the distillates where collected.

No. 1. Temperature of the retort 70°—150° C. a slightly acid colorless liquid of the odor of raw coffee.
No. 2. Temperature of the bath 200°, of the retort 150°—180°.
No. 3. " " 200° " 180°—200°.
No. 4. " " 205° " 205°.

The heat was kept up for an hour at the temperature of 205°. The distillate became more acid as the temperature increased, and the raw smell diminished, being replaced by a disagreeable empyreumatic odor. The coffee at this stage had lost about 14 per cent. of its weight. No. 2 was rectified at 125°, and gave a colorless liquid with a pure odor of raw coffee. After No. 4, the two thermometers indicated the same temperature and the distillates were removed at 200°—250° and 250°; after which the temperature was raised to 270°, at which it was kept for three hours. All of these distillates had a disagreeable empyreumatic smell, which increased towards the end, a small quantity of caffeine had sublimed into the neck of the retort, and on examining the coffee it was found to be imperfectly roasted, those grains which were next the sides of the retort being quite black. The apparatus had therefore to be modified, but we were able from the experiment to verify the limits of temperature between which coffee is said to be roasted, these are, from 200° to 250°.

A sheet copper cylinder, open at each end, of about 7 inches diameter and 14 inches high, was made; a large circular tube gas-burner fitting the cylinder, was placed at the bottom, and about 3 inches therefrom a diaphragm to equalize the heat. About 3 inches from the top of the cylinder a hole was made of sufficient diameter to admit the neck of a Florence flask; and diametrically opposite, a smaller hole to admit a ¼-inch brass rod, to the end of which was attached, cruciform, two slips of sheet brass bent so as to form a clamp which embraced the bottom of its flask, and which, owing to the elasticity of the clamp, could be easily inserted and removed. The brass rod, and with it the flask, was rotated by means of a culinary jack which went by clock-work, and announced its running down by a bell sounding a couple of minutes before the event took place. We had thus a perfect roasting apparatus on a small scale; the temperature of the oven indicated by a thermometer, could be kept steady to a degree, and at once rapidly increased or diminished by means of the gas flame and a cover placed in different positions on top of the cylinder; a tube connecting the flask with Liebig's condenser, enabled its volatile products to be collected. The coffee was burned equally in the flask, no matter at what temperature, and was kept from slipping by a piece of iron wire which was sprung into the flask.

We proposed, in experimenting with this apparatus, to roast as much coffee as would make one cup of the infusion, noting the temperature, collecting the volatile products, and comparing the taste of the coffee made from the berry in the flask (at first alone and then with the addition of the volatile products,) with coffee of the same bean, roasted in the usual manner and of the same strength. It will be well in this place to explain the method adopted by us in making a cup of coffee, that comparison may be made with the experiments to follow.

It has been before stated, that one of us (C. M. W.) has been in the habit for some years past of preparing daily, a morning and evening cup of coffee. It was a desideratum to effect this with the least trouble, and before the present method was adopted many different ways were tried; many of the different coffee machines with alcohol and without, were used; coffee was purchased already roasted, some roasted and ground, the different so-called extracts of coffee used, and raw coffee was obtained and roasted in the laboratory by different methods. The following plan was found the most convenient, the coffee tastes always the same and has been approved of by all who have partaken of it.

The Mocha berry is roasted in a cylindrical drum in quantities of seven or eight pounds. This, indeed, is the most important part of the operation, for if a good berry be *properly roasted* and the infusion be of the proper strength, good coffee *must* result. The roasting process will be more fully alluded to subsequently. The above quantity of coffee when roasted is placed in a stone-ware jar the mouth of which is of 3 inches diameter, and which may be closed air-tight, by hammering in a cork with a piece of buckskin or bladder interposed. This quantity of coffee will make two cups daily for five or six months, and no difference can be detected in the taste at the end of that time. The coffee is ground at intervals to fill a wide mouthed glass stoppered bottle holding a quart or enough to make about thirty cups of coffee; the ground coffee is perfectly preserved in this bottle. The best coffee pot was found to be the common biggin, or that having an upper compartment with perforated bottom upon which is placed the coffee. To make a cup of the infusion, a measure of ground coffee holding half an ounce in weight is placed in this upper compartment and a cup full of water (six fluid ounces) is poured into the bottom compartment and the biggin is placed over a gas lamp. In about three minutes the water boils, and when the steam begins to issue from the top of the coffee pot it is taken from the fire, the water poured into the cup and thence immediately into the top of the biggin, where it extracts the berry by displacement.' If the coffee has been ground to the proper size the liquid runs through freely and is perfectly clear, and with *boiled cream* gives a very delicately flavored beverage. It is important to keep the coffee pot perfectly clean, as the least musty smell indicates a disagreeable taste which is imparted to the coffee.

The following experiments were performed in our small Florence flask roasting apparatus. According to Payen, raw coffee roasted to chestnut brown color, loses 20 per cent. of its weight, and to reddish brown 15 per cent. The quantity for one cup of coffee roasted in the flask was 13·2 grammes of the raw berry, which, to lose 20 per cent., would become 10·5 grms., or somewhat less than one-half an ounce on the quantity taken to make the infusion in the usual manner. To lose 15 per cent., the above quantity would become 11·2 grms.

First Experiment.—13·2 raw coffee raised gradually to 220° and kept at that temperature until of a light brown color; at the end of the operation white fumes made their appearance. Weight of the roasted coffee 11·5 or a little over, 15 per cent. loss of weight, is less brittle than it should be. Infusion of good flavor but weak.

Second Experiment.—13·2 raw berries raised at once to 225,° which temperature was maintained for 22 minutes. At this time the fragrant smell of roasted coffee was emitted, the berry was of the right color and brittleness, and weighed 11·5, the same loss of weight as the last. The infusion excellent, and exactly like that prepared by our usual method.

Third Experiment.—13·2 raw coffee heated at once to 225° and kept there for an hour and a half. The coffee had a very dark appearance and the infusion a disagreeable burned taste. Weight of roasted berry 11 grms. corresponding to a loss of 16·7 per cent.

Fourth Experiment.—The same quantity heated for a quarter of an hour at 225°, and then for an hour and a quarter at 200°; coffee dark and the infusion decidedly bad.

Fifth Experiment.—The same quantity kept at 200° for an hour and a half, when the color appeared right; a fragrant smell came over with the distillates unlike the coffee aroma, and the infusion was almost tasteless compared with good coffee. In these experiments, the distillates had a similar smell and taste. At first an odor of raw coffee appeared, which gave way to a empyreumatic liquid of unpleasant taste, and although at the close of the operations in experiment 2, the smell emitted was aromatic the taste of the distillates was disagreeable. In none of the instances did the distillates added to the infusion of the berry, decidedly improve the taste. The experiments show that the loss of weight is no criterion that the coffee has been properly roasted, neither, (considered alone) does the color nor the temperature to which it has been exposed, nor the time which latter must vary in proportion to the weight of coffee. But it follows, that the coffee must be raised at once to 225° and kept there until it has acquired the proper color, and *at once* when the color is reached, and at the same time when breaking a couple of grains show them to be sufficiently brittle, it must be removed from the fire. At the close of the operation, white fumes begin to come over, the peculiar aromatic smell of roasted coffee is emitted, which directs attention to a particular care to watch the close of the operation. Although 225° is the lowest temperature at which coffee is roasted by our experiment, it does not follow that the temperature of the oven is as low, it should in fact be higher in proportion to the quantity of coffee roasting, in which case, a thorough mixing of the grains is important. By our first experiment with the retort it will be seen, that although the temperature of the oven be constant, that of the coffee rises gradually, which is to be expected.

These experiments were preliminary, our intentions being to ascertain whether the aroma developed by roasting coffee and which is lost, might not be collected and added to the coffee at pleasure, thus increasing its value. In connexion with this, an experiment was performed to ascertain whether the fragrant volatile oils might not be driven from roasted coffee by steam, and a dried extract of the residual coffee made, to which the same oils might be afterwards added, giving a good and portable coffee. To effect this, a pound of the roasted grains was heated in a retort in a water bath, and steam passed over them. The distillate was condensed in a tubulated receiver, the temperature of which was suffered to rise by the operation, from the receiver the vapors passed through a Liebig's condenser into another receiver cooled by salt and ice. The coffee remaining in the retort gave an inferior infusion resembling coffee in taste, and which was somewhat improved by the addition of the liquid in the receiver cooled by salt and ice. The distillate in the first receiver was acid, and curdled the milk when added to the coffee.

(To be Continued.)

For the Journal of the Franklin Institute.

On the cause of Distortions in Photographic Pictures.—A Disclaimer.

By J. F. Mascher.

To the Committee on Publications.

Through the politeness of Dr. W. H. Pile and George W. Smith, both of this City, I have had pointed out to me an article on page 291, Vol. xv, *Sillimans Journal*, for 1853, from Sir David Brewster, on photographic pictures taken with different sized lenses, in which that gentleman points out the true cause of the distortions noticeable in pictures taken with lenses larger than the human eyes; and as I have no desire of appropriating to myself the laurels of others, I cheerfully disclaim so much of my article, on page 345 of your *Journal* for May, as relates to the distortions of pictures, and I can assure you that it affords me much pleasure to make this disclaimer, inasmuch, as that article being from the highest authority of the present age, corroborates the truthfulness of my deductions, not only in respect to the distortions of pictures, but also, indirectly, the balance of my article on page 344 of your *Journal*. I say, corroborates, because it will be self-evident to any one reading the article of Sir David Brewster, that he arrived at precisely the same conclusions in this respect, with myself, although starting from entirely different premises.

It has long ago been noticed by artists, that pictures taken through small diaphragms, were "sharper" than those taken through large lenses without a diaphragm, but who ever pointed out the true cause, before Sir David Brewster did, two years ago, and the additional facts (independent of the stereoscopic angles, &c.,) contained in my article alluded to? The fact has always been explained to me, by artists, upon the principle of a profusion of light—somewhat similar to what takes place when looking at objects through a microscope in which the light is admitted through a large aperture or diaphragm, but it will be seen from the articles alluded to, that this explanation is not correct.

In conclusion, I would earnestly recommend all those interested, to give the article of Sir David Brewster a careful perusal, assuring them that they will be amply rewarded for their time.

Philadelphia, June 25th, 1855.

Modern Rail Bar Rolling.[*]

The Rhymney Iron Works Company has just rolled the largest railway bar ever produced. It is one of Barlow's patent rails, and has been sent to the Paris Exhibition. Previous to the appearance of this example of such rolling, a 22-feet rail was the ultimatum, but the Rhymney Company has gone, at one stride, to a length of 52 feet 6 inches. Mr. G. P. Hubbuck, the managing engineer of the works, conducted the operation, and he has made such excellent work in the present instance, that the rail has not been painted. It is simply brushed over with oil to repel the attacks of rust, and in this condition it will make its appearance in the great show of France.

For the Journal of the Franklin Institute.

Steamboat Metropolis.

Hull built by Samuel Sneden & Whitlock, Green Point, New York; Engine by Stillman, Allen & Co.; Erastus W. Smith, Engineer.

HULL.—

Length on deck,	342	feet.		
" of keel, half scarf,	325	"		
Breadth of beam,	45	"		
" " moulded,	44	"	5	inches.
" " over all,	81	"	2	"
Depth of hold,	16	"		
Length of engine space,	60	"		
Draft of water,	10	"	6	"
Tonnage, (Custom-house,)	2108.			
Contents of coal bunkers, in tons,	50.			

Average speed through the water per hour, 17·8 miles.

ENGINE.—One—vertical beam.—

Diameter of cylinder,	105¼	inches		
Length of stroke,	12	feet.		
Average pressure of steam in pounds,	24.			
" cut-off from commencement of stroke,	4	"	6	"
" revolutions per minute,	15½.			

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[*] From the London Mechanics' Journal, April, 1855.

Boilers.—Four on guards, 2 on either side, back to back, with vertical tubes of brass.

Length of boilers,		20 feet 8 inches.
Breadth "	aft, 13 feet 3 in. forward,	11 " 2 "
Height " exclusive of steam chimney—aft,		13 " 3 "
" " " " "	forward,	11 " 3 "
" steam chimneys,	aft, 7 feet—forward,	8 "
Number of furnaces in each boiler,	2.	
Breadth of furnaces,	forward, 4 feet 9 ins. aft,	5 " 9 "
Shell back of furnace, cylindrical.		
Length of grates,		7 "
Internal diameter of tubes,		2½ "
Heating surface in the 4 boilers, 12,000 sq. ft.		
Diameter of smoke chimney,		6 "
" " " above grate,		62 "
Description of coal,	Anthracite.	
Draft, natural, with fan blower under grates part of the time.		

Paddle Wheels.—Iron.

Diameter,	41 feet.
" over paddles,	40 "
Length of blades,	13 "
Depth "	30 inches.
Dip of wheels, average load,	5 "

Floor timbers and frames double; molded at keel, 20 inches; sided, 20 inches; at tops, molded 8 inches; sided 16 inches; distance between centres 24 inches. Frames of white oak, live oak, and locust; top timbers locust and cedar.

Bottom, keelsoned with 7 tiers, of white oak; centre keelson, 4 feet deep; side keelsons, 3 feet deep; keel molded 14 inches; sided 16 inches. Paddle wheel beams, of white oak, 20 inches square.

Single top timbers, molded, 8 inches, sided, 8 inches, extended to state room deck; 10 feet above main deck and 26 feet above floor; capped with a white oak clamp timber 13 inches square, extending from end to end of boat. Frame strapped diagonally with iron bars 4½×½ inches, one bar to each frame, extending from below the turn of the bilge to the clamp timber capping top timbers.

One half the bars are countersunk flush into frames, the remainder are cross-laid over them at angles of 90°, and the ceiling, bilge keelsons, and clamps scribed over the latter. The bars are riveted at their crossings between the frames and each bar bolted to every frame it crosses, which, together with their being accurately imbedded in the wood, gives the structure great strength and stiffness.

Remarks.—The *Metropolis* is believed to be the largest *steamboat* afloat, and the first that has been constructed with the diagonal iron truss work extending to the state room deck, which adds, probably, 200 per cent. to the longitudinal strength of the hull after cutting out sufficient spaces for the freight, passenger, and fire room gangways, making the usual unsightly timber "hog frames" in general use on large steamboats, unnecessary.

To Mr. Sneden, belongs the credit of introducing this new and important addition of the truss work in the construction of steamboats. The model and execution of work is likewise highly creditable, and will add new laurels to his established reputation.

To engineers and others capable of giving correct judgment, the engine will speak for itself. It will bear comparison with the best specimens of engine work to be found in this country or Europe. Notwithstanding its immense size, the steam chests, side pipes, throttle valve pipe, and entire front of engine, is turned planed and polished in the highest style of the art, and the entire machine exhibits a perfection of execution of which Stillman, Allen & Co., may justly be proud.

The valves, which are of the usual balance description, are fitted with Allen's & Wells' adjustable cut-off, which can be conveniently changed while the engine is in motion to suit the varying requirements of speed or economy. By a peculiar arrangement of the hand gear, the engine is easily worked by hand ahead or back by one man. The engine room is fitted with magnificent and reliable instruments for denoting to the engineer the pressure of steam, condition of the vacuum, temperature of water in the condenser, the rotation and position of the cranks at all times, an engine counter that will exhibit in one row of figures the number of revolutions performed in a minute, passage or year; an indicator operated by the pressure within the cylinder illustrating the internal performance of the piston and valves and degree of expansion; and lastly, a rich patent lever clock with 25 inch dial of silver.

The cylinder is more than one-third larger than that of any other single marine engine in the world, being 1¾-inches larger diameter and 3 feet more stroke than any one of the cylinders of the English steamship *Arabia*, which is 103¼ inches diameter and a stroke of 9 feet, the next largest marine cylinder in existence. The extraordinary capacity of the *Metropolis'* cylinder will, perhaps, be best appreciated when it is known that 22 invited guests found comfortable seats at a table and dejeuner served by Stillman, Allen & Co., within its iron walls. After the table was removed, a horse and top carriage was driven through by Col. Borden and others, the top standing. 103 men then found room to stand erect within the bore of the cylinder.

One of the sticks of yellow pine timber employed in the construction of the gallows frame was 81 feet long, squared 2 feet 10 inches, and contained over 500 cubic feet, the largest ever brought to this market.

The boilers, in general principles, are the same as those introduced with so much success by Mr. Collins on his famous steamships. The shape of boiler and internal arrangement is different, affording simplicity of construction and unequalled facility for cleaning and repairing every part.

The engine is fitted with a self-operating stopping apparatus, arranged by Mr. Smith especially for this boat. It will instantly unhook the eccentric and shut the steam off of the cylinder, the moment when by breakage of any of the parts the cross-head travels ½-inch beyond the stroke prescribed by the cranks. This is believed to be the first application of such an appendage, the importance of which all engineers will appreciate.

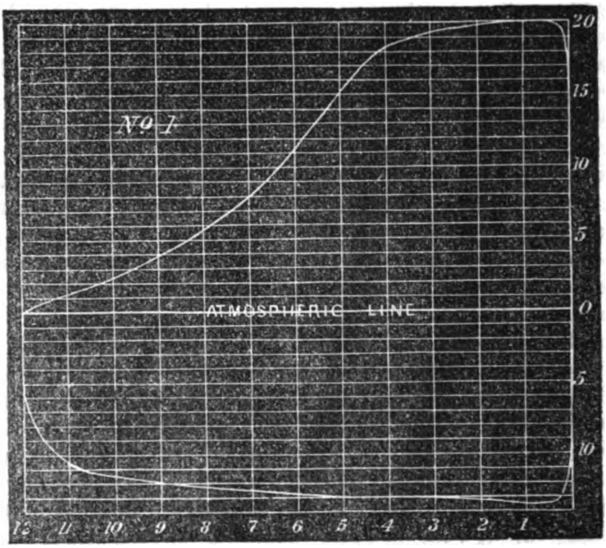
The performance of the *Metropolis* more than equals the most sanguine expectations. Her average speed is one and a half miles per hour faster than the average of the *Bay* and *Empire State*, the sister steamers of the same line, and her consumption of coal is only the same as theirs. The *Bay* and *Empire State* are each 317 feet long on deck; 40 feet beam, and draw with average load, 9 feet 9 inches; each having an engine of 76 inch cylinder, 12 feet stroke, with two flue boilers of the usual description, using fan blast under grates and working a steam pressure varying from 30 to 45 lbs. to the square inch, according to circumstances, and cutting off at ½ and ⅝ths of the stroke, the cut-off being unadjustable when the engine is in motion. Wheels, 38 feet diameter.

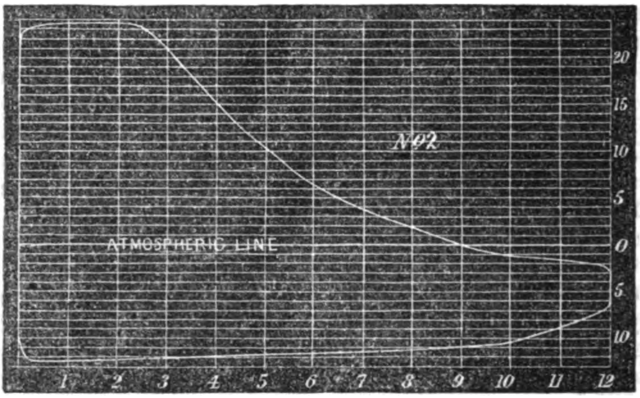
The distance between New York and Fall River is 178 miles. The average running time of the *Bay* and *Empire State* is 11 hours, consuming on an average 88,000 lbs. of coal. The average running time of the *Metropolis* is 10 hours, making the first half of the passage with natural draft only, with a steam pressure of 20 to 24 lbs. cutting off from 4 to 4½ feet of the stroke, and consuming about the same amount 88,000 lbs. of coal. She will make the passage in 11 hours with natural draft the entire passage, and consume only 68,000 lbs. Her best speed is not yet known, as she has never been driven up to her maximum performance. On Saturday, June 9th, she performed the passage from New York to Fall River in 8 hours 51 minutes running time, much the shortest passage on record. The hulls are all from the same builder, and the difference between the models and angle of entrance is immaterial, the only difference being in the *Metropolis* having a little more fullness at the ends and less at the bilges; she being 25 ft. longer, 5 ft. more beam, 550 tons greater burden and drawing with average load 9 inches more water than the above named boats, makes the coal she consumes when performing equal speed, less than two-thirds the proportionate amount. This result is due, no doubt, to the arrangement of the boilers, affording comparitively, a larger amount of fire and grate surface in a condensed form, with less proportionate weight, and ample tubular fire surface of little thickness of metal compared to the plates of flue iron employed in the construction of the ordinary flue boilers, combined with a cylinder of large capacity, fitted with adjustable expansion gear, and every other approved appliance for getting the most useful effect out of the steam while passing through the cylinder before it is ejected into the condenser.

The large area of the cylinder affords the requisite power with the low steam pressure of 20 to 25 lbs. to the square inch, cut off at ⅓d or ⅖ths of the stroke, which becomes expanded to a pressure *below* that of the atmosphere before the end of the stroke, as illustrated by the annexed indicator diagrams; while in the other boats, using the customary small proportion of cylinder to boat, and making up for the want of capacity of cylinder by employing steam of high pressure, cutting off in many instances beyond half stroke, the steam exhausted into condenser at the end of the stroke is 10 to 15 lbs. *above* the atmosphere.

The engine of the *Metropolis* is adapted when working up to full power to steam of only 25 lbs., and as cutting off at from ⅓d to ⅖ths of the stroke has been found in practice to produce the best results commercially, which is, the best balance of forces and expenses considering the weight and cost of engine, and required quantum of fuel to give the best speed after leaving appropiate carrying capacity for freight and passengers; 25 lbs. seems to be about the best working pressure for condensing boat engines where the engine and boilers have been adapted to it: and moreover, the surface, of boilers, steam pipes and cylinder, will radiate much less caloric at the temperature due to 25 of steam, than will be lost at a temperature due to 45. For stationary engines where the weight is no objection, and the boilers and other radiating surfaces can be thoroughly protected with brick work, steam jackets, &c., a higher initial pressure of steam, and greater degree of expansion is desirable, and will be attended with proportionate economy.

The indicator diagrams below, will illustrate the degree and outline of expansion in the *Metropolis* cylinder; No. 1, being from the bottom, cutting-off at 4 feet, and making 15½ revolutions per minute; No. 2, form the top, cutting-off at 3 feet and making 15 revolutions. Expanding the steam to below the pressure of atmosphere.





No. 1		No. 2	
Revolutions, .	15½	Revolutions, .	15
Pressure of steam,	22½ lbs.	Pressure of steam,	24 lbs.
Vacuum per gauge, .	25¼ inches.	Vacuum per gauge, .	25½ inch.
Temperature of hot well,	125° Fah.	Temperature of hot well,	118° Fah.
Throttle valve .	open.	Throttle valve .	open.

The cabin arrangements differ from those of any other steamer in our waters. In the body of the boat below main deck, there are 304 berths in tiers of four on either side, in one unbroken range, of about 275 feet. In the ladies' saloon there are 96 berths, in four tiers of three, one tier on either side and two in the centre of the saloon, back to back; the great beam of boat admitting of this arrangement, which, without crowding, adds 100 per cent. to the berth capacity of the saloon.

On the state room deck there are 94 single and double rooms, 13 being furnished with double bedsteads, with gorgeous furniture and drapery that cannot fail to please the most fastidious bridal parties. The state rooms forward and aft the engine, are ranged in pairs athwartship, on either side of the boat, and connected by a central door which admits of two rooms being converted into one when found agreeable by families or friends. The rooms are entered from the state room saloon by an alcove which communicates with the doors of two pairs of rooms, and which admits of the light for each room being inserted in a pocket or lantern by the servant from the outside, thus greatly reducing the liability of fire from lights in the hands of the passengers. A toilet room and retiring apartments on the state room deck is a new and very convenient provision for the lady passengers on that deck. There are also gentlemen's retiring apartments on the opposite side of the saloon. The state room deck is extended to the stem, covering the entire main deck, which is enclosed by bulwarks. The furniture of the state room and ladies' saloons is rosewood, upholstered with moket of various and elegant patterns; the carpets are double velvet tapestry. The appointments throughout, are both comfortable and luxurious.

The *Metropolis* is provided with two of Worthington's steam fire engines, each capable of throwing three efficient fire jets; and has, besides, two hand fire engines, and a means of converting the boiler force pumps into fire pumps; and an ample provision of fire hose, buckets, and axes, and carries eight life boats and 1000 life preservers.

The traveling public are indebted to Colonel Richard Borden, President of the Bay State Steam Boat Company, for this gigantic and efficient addition to the steam palaces for which this country is deservedly celebrated. He had, besides the enterprise and liberality necessary to produce such a structure, what is *equally* necessary to prodcce the highest result in any undertaking, confidence in the principal mechanicians he had employed; and after giving their plans due consideration, invariably gave them his confidence and patronage.

The *Metropolis* is under the command of Captain William Brown, and runs between New York, Newport, and Fall River, on the Boston route, in connexion with the steamers *Bay* and *Empire State*. E. W. S.

*Permanent Impressions of Flowers on Glass.**

Mr. Robert Smith, of Blackford, who has often contributed to our pages, has contrived a very ingenious and effective plan of ornamenting glass, by producing thereon, permanent impressions of flowers, leaves of plants, and other objects. In this process of ornamentation, the operator goes to work by first preparing the objects to be reproduced on the glass surface with a solution of gum. The details of the figure are thus attached to the glass, in the positions required by the device. The entire face of the glass thus treated, is then covered over with a composition of oil, tallow, and wax, in a warm state. When this composition coat becomes solid, the objects are removed from the glass, which is now submitted to the action of fluorine gas; or liquid fluorine may be poured upon the glass; or further, the plate may be treated with fluor spar and sulphuric acid. This is the ordinary treatment involved in glass etching—the peculiarity of Mr. Smith's process being the mode in which the design or the line of action of the acid is produced. The fluorine corrodes the glass only at the parts where the flowers or pattern objects have been placed, and hence the forms of the objects, however elaborate or delicate, are faithfully reproduced from the models supplied by nature herself. The ornamental designs produced in this way are extremely beautiful, contrasting as strongly with the result of ordinary staining, as does a good daguerreotype picture, or nature painting, with a mechanically produced engraving; the figuring accomplished in this way may be colored as fancy suggests, by the common process of baking or "burning-in" in a furnace. This is another of those processes, by which we are now compelling nature to reproduce for us her choicest devices in a more enduring form.

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* From the Lond. Pract. Mech. Journ., April, 1855.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, June 21st, 1855.

John Agnew, Vice President, in the chair.

Isaac B. Garrigues, Recording Secretary.

A letter was read from the Royal Society, London.

The minutes of the last meeting were read and approved.

Donations to the Library were received from the Imperial Royal Geological Institute, of Vienna, Austria; The Regents of the University of the State of New York; J. S. Dodge, Esq., of Rome, and J. A. Roebling, Esq., of Rochester, New York; L. J. Fleming, Esq., Wilmington, N. Carolina; The Maryland Institute, Baltimore, Maryland; The Select and Common Councils of City of Philadelphia; and from Messrs. A. J. Brazier, Professor M. H. Boyé, S. V. Merrick, and Frederick Graff, Phila.

Donations to the Cabinets from Messrs. W. S. Vaux, Professor B. H. Rand, and W. Jones, of Philadelphia.

The periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statement of the receipts and expenditures for June, was read.

The Board of Managers and Standing Committees reported their minutes.

Resignations of membership in the Institute by six gentlemen were read and accepted.

The candidates for membership in the Institute, (7,) were proposed, and the candidates proposed at the last meeting, (8,) were duly elected.

PALMER'S PATENT LEG.

This world renowned Artificial Limb, it will be recollected, was among the *few* signal triumphs of American ingenuity exhibited in the World's Exhibition in 1851. It there received the award of the Great Prize Medal, as the "*best*" limb (amongst thirty of the best English, French, and German manufacture) exhibited; and was so well appreciated, that an extensive manufactory is now in successful operation at 30 Regent Street, London, under the auspices of the Queen and the Medical Faculty of London and Paris.

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J. J. GREENOUGH,

Solicitor of Patents, Editor of the Pylotechnic Journal, and Consulting Engineer,

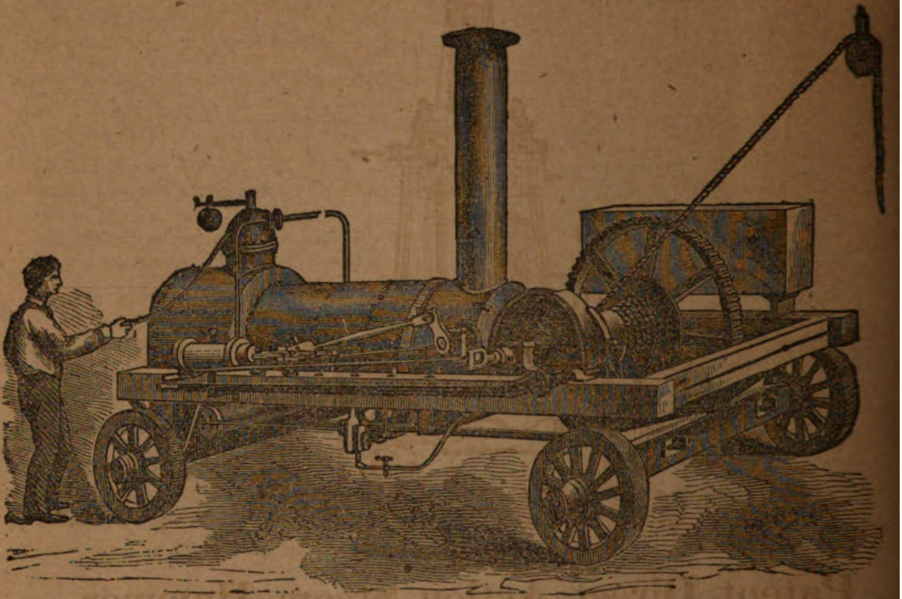
Has removed his Office from Washington, to

No. 6 WALL STREET, NEW YORK.

He continues to prepare and argue cases before the United States Patent Office, and obtain Patents in Foreign Countries, and Plans and Specifications for Machinery.

A connexion, official and otherwise, of more than sixteen years with the United States Patent Office, renders references superfluous.

A. L. ARCHAMBAULT'S
PORTABLE STEAM
HOISTING AND PUMPING ENGINE.



THE FRANKLIN INSTITUTE, at their Exhibitions in 1851 and 1853, awarded a First Premium (Silver Medal) for a PORTABLE STEAM HOISTING AND PUMPING ENGINE, for Loading and Discharging Cargoes, Pile Driving, Raising Iron Ore from Mines, Pumping Water, Driving Ore Washers, &c. Also arranged for driving Portable and Stationary Saw and Grist Mills; several are now in full operation. A First Premium and Diploma was also awarded by the PENN'A. STATE AGRICULTURAL SOCIETY, at their Exhibition at Philadelphia, 1854.

The Engine, which was exhibited at the Franklin Institute in 1851, was purchased by the Philadelphia Gas Company, and used for several months in raising water with elevators and hoisting. This engine having been superseded by another of increased power, in 1852, was afterwards purchased by the Schuylkill Navigation Company. Major Jones has had one in operation on his farm in Cecil County, Maryland, for some months, as a substitute for the horse-power formerly used by him in driving his threshing machine. Another was constructed by order of Pierce Butler, Esq., to be employed on the lands of the North American Coal Company. In 1853, a double cylinder Hoisting Engine was built for the Schuylkill Navigation Co. One for J. J. Holland, of Williston, S. C., with two 8-inch cylinders, for driving a Portable Saw Mill. One for the Philadelphia and Reading Railroad Co., with two 8-inch cylinders, for pumping. One for the Lebanon Furnaces, with two 6-inch cylinders, for hoisting coal and iron. One for the Dauphin and Susquehanna Railroad Co., with two 6-inch cylinders, for hoisting stone, &c., for bridge building. One for the Dauphin and Susquehanna Coal Co., for hoisting and pumping; and one for J. Sterrell & Co., Mifflin, Pa., for driving Barrel machinery.

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References.—Prof. J. C. Cresson, Supt. Phila. Gas Works; Thos. I. Potts, Iron Merchant; Pierce Butler, Esq.; Rob. Kelton, 113 N. Water st.; H. Haupt, Chf. Eng. Penn'a. R. R. Co.; L. G. Mytinger; A. S. & W. L. Roberts, 80½ Walnut St.; Wm. Mahone, Chf. Eng., Norfolk & P. R. R. Co.; S. B. Sutton, St. George's, Del.; C. P. Morton, Mortonville, Chester County, Pa.; Sam'l. Entriken, Paoli, Pa.; Richard Hecksher, Minersville, Pa.; J. Dutton Steel, Esq., Civil Eng. Phila. & Reading R. R. Co.; R. B. Osborn, Chf. Eng. Dauphin & Susq. R. R. Co.; F. Fraley, Pres. Sch. Nav'n Co.; S. A. & W. Henderson, Norristown; Spencer & Mason, Pottsville; G. D. Coleman, Lebanon, Penn.; J. J. Holland, Williston, S. C; Maj. John Jones, Md.

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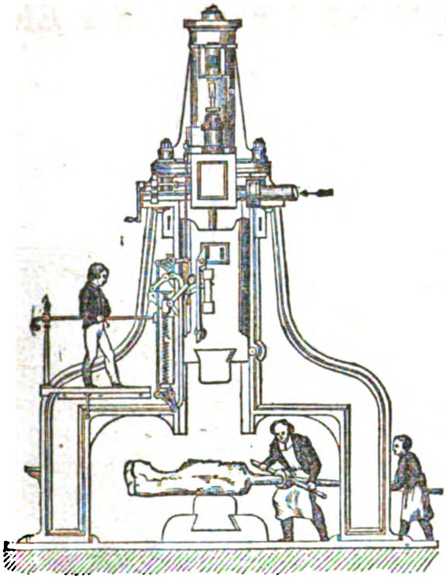

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2d, The intensity of the blow may be modified instantly by the attendant, so as to suit the work; and the Ram may in like manner be *arrested in its descent* at any point, so that it is more completely under control than any other form known.

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OF THE

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OF THE

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FOR THE PROMOTION OF THE MECHANIC ARTS.

DEVOTED TO

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The series of Reports of important Patent Law cases adjudicated in the United States Courts, which will be continued by the able Reporter who has hitherto furnished them for the Journal; and the copious index of Patents from 1828 to the present day, which is digested semi-annually and arranged chronologically, being the only complete index published regularly during that period, make it indispensable as a book of reference to those interested in this branch of Jurisprudence. To Engineers and Ship Builders its pages offer a record of the dimensions and the particulars of the performance of steamers built or building in the United States and abroad, of which the value can be best appreciated by those engaged in the construction of steam vessels. The number of correspondents in this department is large and rapidly increasing.

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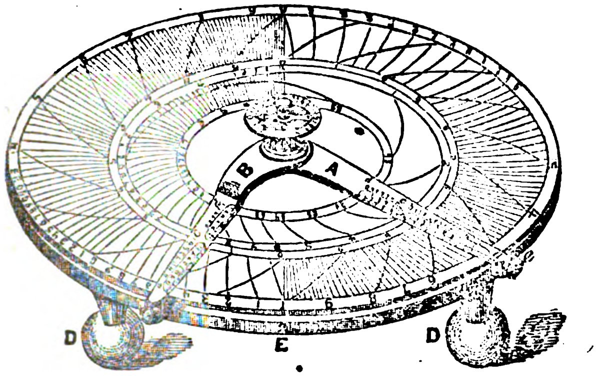

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JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

AUGUST, 1855.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Marine Propulsion; or the Influence of "Form" in Propelling Blades.

By Thomas Ewbank, Washington, D. C.

A conviction that the principles of propelling, partially unfolded in the experiments first reported in the Journal,* and embodied in the Patent Office Report, of 1849, must eventually be recognised, induces me to offer the following remarks on the subject:

An increase of speed in ocean steamers is of acknowledged importance to the commercial and social interests of the world. Is it attainable? Yes; for no truth is more certain, though it may not be perceived, or but dimly perceived, that every acquisition in the arts is a step in the order of progression that serves, or ought to serve, as a fresh starting point to enable us to keep rising in mechanical knowledge and in its applications. How, then, is it to be achieved? Not by blind experiments, which have been tried long enough. In common with the lower tribes, we can meet exigencies in the arts with instinctive devices, and continue to meet others by the suggestions of experience; but there is a limit to empiricism, and then, in order to advance, an appeal to principles becomes necessary, because new bases of operation are wanted, which are not obvious to sense, and which nothing but an investigation of principles can disclose. To some extent this is, I think, applicable to steamers. There is an element in the propulsion of vessels that has hitherto been overlooked, and upon it, I believe, the next step in advance must be based.

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* See Volume XVII, p. 42.

I wish to urge the value of *form* in propelling blades; for I am sure that in it is to be realized the desideratum of speed. A correct outline is every thing in those instruments, because every desirable quality *flows from it*—qualities which it is impossible to realize with the old rectangular planks in common use. I question if a grosser example of neglect of form than these present can be named, or where the consequences have been so serious—examples of greater looseness about principles and greater persistence in malpractice. Among the higher or even lower classes of machinery few such deviations from rectitude can be found, and fewer still that have been so long borne with. But it has happened to them, as to other characters whose proclivities to wrong-doing are innate—they have been endured till a sense of their deformities has vanished.

Though we may bungle along with misshapen blades, we cannot elude the penalties attached to them—as great waste of power, unnatural wear and tear, constant straining of the vessel, no marked increase of speed, and a premature breaking up of the whole. Of this severe punishment for neglect of form the history of steamers is replete; but, unfortunately, offenders are insensible to the offence and to what it costs them. This is not, however, the case in all things; and hence, while steamships still spend much of their costly power for naught; while their wheels continue uselessly to thrash the water and heave up tons over them; while their machinery is jarred and their massive shafting now and then wrenched apart by excessive strainings, the hulls are not kept in such violent and ceaseless paralytic tremblings as formerly. Modern vessels outstrip former ones because their outlines have been improved, and when equal efforts are made to improve those of propelling blades, steamers will begin to be what they ought to be.

Admitting that much is to be done in the construction of vessels and in motive machinery, their rate of going must continue to depend on their propelling apparatus. While it is defective, fleetness is unattainable, though all things else were perfect. The finest formed flyers move heavily with crippled wings, and we can have no swift skimmers of the seas with deformed organs of motion. Believing, as I do, that success is to be found in the true form of propelling blades, the following observations are submitted to marine engineers. Should they conclude that there is nothing in them, nor in the simple proposition itself, I would ask in what direction do *they* expect to succeed? On what other parts of a steamer do they propose to operate? On the hull, the boiler, the engine, or the wheels? On the number, width, depth, and dip of the buckets, &c.? Surely, on these points nothing decidedly new or promising can be expected, much less the development of *new elements* of propulsion; for, after all, that is what is wanted. The squeezing out, by extraordinary exertions, of a few more feet or rods to the hour will not satisfy the present age, let alone future ages. It would only show that the virtue of the present paddle is exhausted; that nothing, or next to nothing, more is to be got out of it.

But are new elements of speed to be elicited from the mere shape or outlines of the blade? Yes. But paddle-blades have long been experimented on, and the result has led to the universal preference of the original rectangular slabs, and to the recognition of the primitive wheel as "the prince of propelling devices for speed?" True, and the fact is conclusive that the existence of virtue in the *form* of the buckets is not suspected. It is not sought for, and consequently not found. Planks were the readiest forms and materials at hand in the beginning, and were with little reflection adopted, just as they have been continued. It is demonstrable that the highest attainable speed is impossible with paddle-planks, utterly impossible, and that it can only be attained in connexion with other engineering desiderata; such as the least waste of power, the least amount of material in the blades, the diffusion of the resistance over their entire surfaces, every section producing equal effects though very unequal in area, the centre of resistance not at the extremity but in the centre of the blade, and thereby putting the least strain upon the arms or levers. When these properties and the utmost *thinness* in blades, their smooth working, freedom from liability to sudden or increased strains are acquired, the true form will have been obtained, and, what may appear problematical to many, they will be found to have proceeded from it—illustrating a cardinal truth in physics, that in proportion as a device approaches the truth in form, it approaches it in every other particular.

It is, however, a melancholy fact that there is among our engineers a prevailing indifference to and unbelief in the value of form, which can only be ascribed to their not having looked into the subject. They do not perceive how two blades of equal areas, but differing in their outlines, should possess different properties; surface, not boundaries, being what they rely on.

That there is an innate relationship between cause and effect, and that the latter is modified by the instruments through which the former acts, is obvious to every body. A blunt, that is, a badly formed tool, consumes more power than a sharp one, and gives inferior results; so it is with every thing through which force is conveyed. Mechanical science rests upon principles that determine forms and proportions. *There is of necessity a best form for every thing and for every purpose.*

What, then, is the form of propelling-blades which communicates properties not found in common ones? In general terms, it is that which is exemplified in Nature's blades. The law that determines them makes them *long*, *narrow*, *tapered*, and *pointed*, and contracts and expands these features as speed is to be diminished or increased. The form and application, are antipodal to rectangular buckets, because the blade must taper as it dips; the deeper it enters the water the narrower it must become.

The effects of this simple change of form are as surprising as they are important. The most essential attributes of a propeller are evolved.

1. *The least amount of material in the blades.* They are not made uniform in thickness, but are thinned away towards their extremities, a feature incompatible with rectangular blades.

As the reduction of thickness of natural blades outwards is a permanent feature under all circumstances, it might have been inferred from that fact that the same trait might be indispensable to success in artificial propulsion. It has not been so inferred, and we are therefore led at once to inquire why natural blades are reduced outwards and to a mere film? Because length of stroke virtually *diminishes with thickness*, and *a waste of power keeps pace with it.* This is demonstrated in our paddle-wheels. If a pair of these were made in the form of close drums or solid cylinders, they could of course have no propelling power whatever; no more than have grindstones revolving in their troughs. Suppose half of each removed and the usual number of arms and buckets or blades put in their places, the wheels, as they might then be called, could have only half the usual power; and if one-third, one-fifth, or any other proportion of the cylinder were left; in the same proportion would their capacity for propulsion be neutralized. It is, therefore, an inexpugnable truth that whatever may be the number of blades in a wheel, the sum of their thickness must be deducted in every revolution from their sweep through the water, in order to determine their propelling capacity or the work they should perform. In the supposed case of half the wheels being solid, the semi-cylindrical masses were simply distorted blades.

Taking the mean thickness and number of the massive planks that constitute the blades of ocean steamers, they lose from this cause from eight to ten feet of stroke in every turn of each wheel. Assuming two hundred and fifty thousand revolutions as the average number in a trip across the Atlantic, over five hundred miles of stroke are thus lost in each wheel; or, in other words, between twenty and thirty thousand pounds of timber are whirled that distance through air and water, and to no purpose but consuming power and wearing out the motive machinery. We may commit all manner of delinquencies in construction, but we cannot harmonize a philosophical truth with an opposite error. *Thinness* of blades and the *least material* in them, and the consequent least expenditure of power, depend upon form. There is no separating them. Instead of being tapered away toward their extremities as in natural instruments, ordinary blades are made as blunt there as any where else. They are, in fact, often made thicker by bolting on additional slats, and, they require this, since the resistance is accumulated there.

2. In the *reduction of the number of blades.* The adoption of tapered ones would enable us to throw overboard two-thirds or three-fourths of the number now used, with the same proportion of shafting, as not simply useless, but positively injurious. This cannot be done with the present blades, on account of the jarring caused by their violently slapping the water as they come down upon it. When few blades are used the effects of this are seriously destructive; and hence to reduce the concussion the number is increased, on the principle of dividing a few large blows into many little ones. Some boats have had seventy-two blades, on each wheel; many have now thirty-six. Thus one error called in another, for it was not perceived that as their number was multiplied their efficacy was diminished.

A correct form would have removed the evil at once and the cause of it. Instead of a propelling surface, extending from twelve to fifteen feet from a vessel's side, being brought in sudden conflict with a wave, a mere point of the blade would have been presented to it. Instead of attempting to arrest the swell, and be shaken or carried away by it, it would go softly and silently into and through it.

3. In *removing the centre of pressure* from near the extremity *to the centre of the blade*, and in an *equable distribution of pressure over its face.* It is the characteristic of a good and durable instrument that its material is so distributed that every part contributes its due proportion of influence towards the intended result, *and no more.* No other criterion than this is required to determine degrees of worth or worthlessness. How is it with rectangular blades? Why, in truth, it must be admitted that in this respect they are defective, and to a degree which I suspect can hardly be paralleled in modern mechanism. Their lower parts, sweeping through greater spaces in the same time than those above them, do most of the work, nearly all of it, and thus destroy the equilibrium of pressure on the face of a blade, which, *above all things* else, should be secured, and introduce an element of destruction that reaches from them to every thing connected with them. One-third of a steamer's blades have been removed from their upper parts without diminishing in the least her speed; a result that might safely be predicted of some boats now running.

An equable distribution or equilibrium of pressure on a surface whose several sections are immersed at unequal depths and moved with unequal velocities might seem impossible on a first thought; but a second one would suggest that there must be, *per se*, some provision of the kind for this class of movements, as there are for others, and that, too, by varying the outlines of the surface without enlarging it—a principle equivalent to that exemplified in the lever by simply moving the fulcrum; and in fluids to that by which a pint of water may be made to balance a gallon or a thousand gallons; THE principle in fact which raises or lowers the centre of pressure on a blade, not by adding anything to it, but by merely widening or narrowing it—*which modifies velocity by surface and surface by velocity*, so that every portion meets only its proper amount of resistance, and all portions harmonize in bringing out one result.

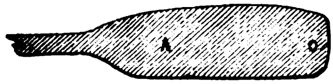
4. Another beautiful result is, that though the blades may taper to a point, a section near that point does just as much work as an equal section through the widest part: extended sweep compensating for diminished surface.

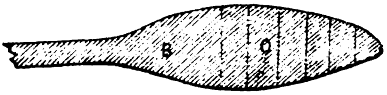
Such are some of the results of form in propelling blades, and they are what are now wanted to enable us to begin a new career in ocean steamers.

Variously shaped blades have been tried on the stern submerged propeller, but for them no definite form has been developed. Most of them are as wide of the truth as the planks of side-wheels. The resistance is accumulated at their extremities; the largest extent of surface is there, and consequently the greatest strain upon the levers or arms and shafts. The true form, whether worked at the side or stern of a vessel, is only to be determined by the properties named, and, as already remarked, they are applicable to every propeller. The law makes no discrimination in favor of one application over another.

The blades of *oars* partake of the same defect as those of steamers' wheels, though in a less degree, because of their being applied in the direction of their length, instead of being attached across the ends of their levers. Uniform in width, the parts farthest from the centre of motion move with greater velocity than the rest, and hence it is the end of an oar that does most of the work: portions in the rear move slower than it—they are *behind* it in their action and cannot therefore sympathise or coalesce with it. In some oars the ends of the blades are wider than the other parts, when the defect is still greater.

To enable an oar blade to return an equivalent for the power transmitted, it should diminish in width from near the middle of its length, and in such a ratio that every part may perform an equal proportion of work, and in *unison* with every other part. In the common blade, A, the centre of resistance from the water is near O; but let *the same amount of surface* be formed like B, and the centre of resistance would be at the same distance from the centre of motion, while the end of the blade would be thrown further out, and greater effects obtained by the same power. Every section, from the middle of the blade to the pointed extremity, would then be equally effective, though so unequal in area, because its surface, multiplied by its velocity, would give the same resultant as every other section. In such a blade, no part could embarrass the perfect action of any other part. All would be in accord.





The object of the foregoing remarks is to awaken attention to a problem in practical science, than which there are few of greater and none of more immediate value.

It is greatly to be desired that the Government would institute, through a commission, a series of experiments to determine the true forms and proportions of propelling blades. The report would be of permanent, and world-wide interest.

For the Journal of the Franklin Institute.

Description of Atherton's Patent Steam Engine. By H. Howson, C. E., Philadelphia.

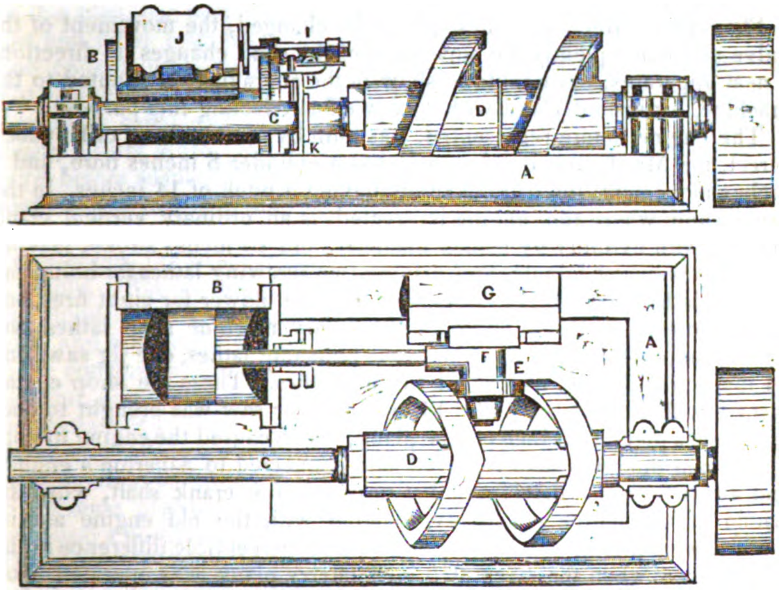
The annexed engraving represents in an elevation and ground plan, Atherton's steam engine, the novelty of which, consists in producing a rotary motion from the rectilinear movement of a piston rod without the intervention of a crank. No little ingenuity has been expended in endeavoring to produce a substitute for the crank, and from time to time, appear contrivances and propositions to effect that object, without making any inroads in the practice of engineers, however, who continue to adhere with excusable pertinacity to the old-fashioned time-honored movement.

No sooner is a new device brought before the notice of the public, or a new scheme proposed to take the place of what must still be deemed an efficient means of producing a rotary motion, than after a few efforts at notoriety it expires, its brief existence being little known beyond a passing notice of some periodical or the exhibition of a miniature model.

It is not, therefore, much to be wondered at, that practical men are apt to look with an eye of suspicion on all such innovations, and to treat with incredulity, attended, doubtless, with no little prejudice, any attempt to discard their favorite crank.

Against all these influences, Mr. Atherton has had to strive in bringing his invention before the public, no little credit being due to that gentleman for his earnest endeavors to give it a thorough practical test. Without being content with the results of a model, which in few instances can be considered a fair experiment in developing the true effects of any new machine, he has had an engine of considerable size built, and proved its efficacy as compared with an ordinary crank engine.

Without speculating as to the ultimate result and general success of Mr. Atherton's engine, the writer will at once refer to the following outline description of the machine, and of its actual performance as brought immediately under his notice, leaving it for more experienced engineers to deduce their own theories, and arrive at their own conclusions. Whatever the result of their investigations may be, favorable or otherwise, every credit is none the less due to the inventor for the perseverance with which he brought his contrivance to a practical bearing, and for the manner in which he has courted the examination and opinions of the public.



A, is the base plate, to which is secured a cylinder, B, with piston, piston-rod and slide valve of the common construction. C is the shaft, which takes the place of the ordinary crank shaft, placed, however, longitudinally with the cylinder, instead of at right angles to it, as in other engines.

At the end of this shaft, furthest from the cylinder, is what may be termed a double scroll cam, D, formed of two curved rings connected by arms to a central hub. The curves of these rings are of the shape of a screw, with a pitch of 14 inches, one-half of each ring, however, represents the thread of a right handed, the other of a left handed screw; in other words, the course of the thread after traversing half the circumference, instead of pursuing the regular inclined course of an ordinary screw, returns the same way, assuming the form represented in the engraving.

Between the two rings works the roller, E, attached to the cross-head, F, which is secured to the piston-rod in the usual manner, and slides on the permanent guide, G. It will be evident that as the roller is moved backwards and forwards by the steam cylinder, its pressure against the inside of one or other of the rings, must cause the same to turn, the reversed direction of the incline on the rings, producing a continuous rotary motion.

The peculiar situation of the shaft, in regard to the position of the cylinder, rendered it necessary to substitute some driving apparatus for the valves instead of the ordinary eccentric.

The inventor's ingenious contrivance, consists in attaching to the shaft, C, a rod, K, with inclined planes at each end; the latter, as the shaft revolves, pass between two small rollers, on the flat portion, I, of the valve rod, the amount of movement being regulated by the degree of inclination of the planes.

Should the direction of these planes be changed, the movement of the valve and consequently the movement of the shaft changes its direction; a neat apparatus, too minute to show in the engraving, is adapted to the machine, for instantly and without any effort effecting this purpose.

The engine before represented, was built by Mr. Gardner, of Haydock Street, for Mr. James Barclay, and has a cylinder 8 inches bore, and 7 inches movement, the driving screw having a pitch of 14 inches. In the same shop where this engine is erected, is an ordinary vertical crank engine, with cylinder 6¼ inches diameter, and 18 inches stroke, making 70 revolutions per minute, and driving two screwing lathes for bolts, one tapping lathe, two turning lathes for bolts, one blower for eight fires, one small blower for steam boiler, six ordinary machine shop lathes, one grindstone, one drilling machine, four polishing lathes, one jig saw, one 14 inch circular saw, two wood turning lathes. These the shop engine turned with facility, until the 14 inch circular saw was brought to operate upon a piece of 3 inch cherry plank, which caused the engine to stop. The steam pipe was then removed and connected to Atherton's engine, and a belt from the driving pulley passed to the crank shaft, when the whole of the above machinery, together with the old engine and its pumps, were driven with facility and with no perceptible difference in the speed, even when the piece of 3 inch cherry plank was operated upon by the circular saw.

Such was the extraordinary result obtained, a result unexpected by all who had examined the model, as well as the engine itself.

A slight jar was observed, as the roller passed the point where the incline of the screw reverses; this may be attributed in some measure, however, to the imperfect manner in which the engine was screwed to a temporary foundation, and to the fact, that several of the parts were slightly built, causing a spring, which in the next engine will be obviated by adding considerably to it in strength of metal.

The engine in question has been forwarded to England by the owner, Mr. James Barclay, who is about to have another built of the same dimensions, in order still further to test its powers, when those interested in such matters will have opportunities of witnessing the experiments.

Storms' Cloud Engine.

We have already published in this Journal, (Vol. xxviii, page 343, Third Series,) a brief account of this engine, from the pen of Wm. H. Shock, Esq., U. S. N. The following extract from the *New York Tribune*, gives an outline of the principles on which the apparent gain obtained by the combination of air and steam over those from steam alone, is explained. The experiments alluded to in the concluding paragraph were conducted, we believe, under the superintendence of Chas. W. Copeland, Esq.

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Mr. Wm. Mount Storms, of this City, a gentleman apparently well versed in all that relates to these interesting and extensive subjects, professes to have made new discoveries or applications of natural laws, which are to result in increasing the efficiency of a given amount of fuel in the steam-engine. The company formed to carry out and apply the intentions of Mr. Storms, hâve subjected the theory to the test of several expensive experiments, and one engine of respectable size constructed on this plan, has been for some months in actual daily use, driving the fans and other machinery of a small foundry and machine-shop. The plan consists in mixing cold air with ordinary steam. It is assumed that in addition to the familiar forms of ice, water, and steam, the aqueous element is capable of existing in a state of vesicular vapor, or opaque steam, a form more familiar to the eye than the transparent steam, but never before suspected of possessing any mechanical power above or even equal to that of the latter.

If a glass bull's eye be introduced in the top or side of an ordinary steam-boiler, the steam within is found to be perfectly transparent and invisible. But on turning a cock the escaping steam is found to be white and cloud-like. This is due to the cooling effect of the air, which mixes with, and apparently condenses it. Mr. Storms's experiments lead him to the conclusion, that the volume of the whole is increased by the combination, and this to a very considerable degree, as high under favorable circumstances as 75 per cent., and consequently affording a corresponding increase of efficiency in an engine. If common air be compressed and introduced at an ordinary temperature, into a vessel containing steam at the same pressure, the following effects may be anticipated. On the one hand a portion of the steam will be condensed and changed to water, which will diminish the pressure; but on the other hand the air will be heated and expanded; and these two effects may be supposed very nearly if not exactly to balance each other. But the experiments alluded to indicate a very decided increase of volume, provided there is a sufficient difference of temperature. If pure transparent steam be mingled with air, previously heated to the same degree, none of this expansion is experienced, and it becomes a question how to compress air in a pump, and convey it in a cold state into a heated cylinder.

Mr. Storms avoids the solution of this difficult problem, by allowing the air to mix thoroughly with the steam, at any temperature it may chance to have, cooling it afterwards by expansion. In other words, he mixes hot or warm air with the steam in the steam-chest, and does not expect the mixture to assume the cloud form, until it commences to expand in the cylinder. The act of expanding cools both steam and air, but in very different proportions. Pure steam of a high pressure, (say 60 lbs.) has a temperature of about 310° F., and if cut off at half-stroke, so as to double its volume by expansion, cools down to only about 270°, while air at the same temperature, if expanded to the same extent, cools down to about the freezing point. Thus the combined fluids may readily be compelled by expansion, to assume the form of cloud or vesicular vapor, if the presence of air at a different temperature be the only condition necessary. To accomplish this object in an ordinary horizontal engine, Mr. Storms has, in the instance above referred to, placed a double-acting air-pump near the cylinder, and allows it to discharge into the steam-chest just above the valve. As the first portion of the stroke of the pump is spent in simply compressing its contents, it is so timed that it will begin to deliver with the commencement of the stroke of the piston. The pump is enveloped in a jacket of cold water to keep it cool, and the air probably enters the steam-chest at a temperature of from 180° to 250°.

A series of experiments have been lately tried at the Novelty Works on a tolerably large scale. The engine was run first with steam alone, and then with the cloud combination, the resistance being constant in all cases. The revolutions produced per lb. of coal were as follows: Steam 107, cloud 190; showing a great advantage by the use of the cloud vapor.

*Miles's Hydrostatic Railway Brake.**

The Shrewsbury and Hereford Railway has just been the scene of an interesting trial of this invention, under the auspices of several eminent railway authorities and men of science. The testing train left the Shrewsbury station at 12·30, arrived at the city at 2·40, stopping at the usual stations on its way. The patent brake alone was used during the journey, and upon the arrival of the train at this station, a number of experiments were tried upon different portions of railway, principally to ascertain the distance and time in which a train could be arrested. Notwithstanding the usual drawbacks to working all new inventions, the train was easily stopped, when going forty miles per hour, in 300 yards, the usual distance with the ordinary brakes being about 1750 yards. Colonel Kennedy and other gentlemen, who tried these tests, expressed a strong opinion that, with the slight enlargement of the tender cylinder, pointed out by Mr. Miles, a train would be stopped with ease in three yards to the mile; that is to say, a train going forty miles per hour would stop in 120 yards. The experimental train left this city, with the usual mails and passengers, at 6·45, and arrived at Shrewsbury at 9·15, using the patent brake during its course, still proving itself most effective. The brakes themselves are upon the usual principle, but are placed upon every carriage, instead of on one or two only. A cylinder is fixed under the carriage, 4½ inches diameter and 3 inches stroke; and in this cylinder is fitted a solid piston, the rod of which is attached to the lever of the brake. Into each side of the cylinder is screwed an iron tube, one inch in diameter, and terminating, at each end of the carriage, with a joint of a novel character.

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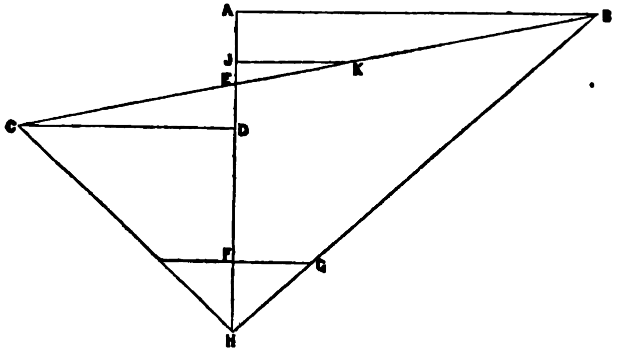
* From the Lond. Pract. Mech. Journal, June, 1855.

When the carriages are connected, the tubes are made continuous by inserting into these joints a flexible tube between each carriage: and when the engine is attached to the train, that is also connected by a flexible tube, leading into tubes fixed in the bottom of the tender, which tubes are merely for the purpose of reducing the temperature of the water used in applying the brakes. The boiler is fitted with a stop-cock near the starting lever, and from this cock is a tube connected to the tubes in the tender. When a train is made up, and the engine attached, a cock inside the tender is opened, and the tubes throughout the train are allowed to fill themselves with water; water being only compressible to the extent of 1 inch in 15,000, is always ready to be acted upon at the moment. At the present day, locomotives are worked at a pressure of from 100 to 150 lbs. per square inch; but for example's sake, we will take the lowest figure; therefore, with the cylinders before described, a power of 1500 lbs. is given to each brake, no matter what may be the number of carriages in the train. The cylinder to work the tender brake is 4½ inches diameter, with a 6 inch stroke, and gives a force of 3000 lbs. The mode of bringing the brakes into use is this:—The engine driver shuts off his steam, opens the cock named in boiler, and in one second, the whole of the brakes are on the wheels, and are taken off by the driver shutting the cock in the boiler, and opening the one in the tender.

For the Journal of the Franklin Institute.

To ascertain the Location of Slope Stakes in laying out Cuttings or Embankments for Railroads, Canals, &c. By R. G. Hatfield, *Architect, N. Y.*

Let the required distances, AB and CD, equal x and y respectively; let the half of the road bed, FG$=a$; the observed height over the centre of the road bed, EF$=h$: the ratio of the slope of the cutting, BG,$=1 : s$,



as seen in the proportion FG : FH : : 1: $s = \frac{FH}{FG}$, and from which FH = FG.s = as. In like manner let the ratio of the grade CB $= 1 : g$, thus— JK : JE : : 1: $g = \frac{JE}{JK}$ and by similar triangles, AB : AE : : 1 : g, from which AE = AB. $g = gx$; the difference of level of the two points, E and K, having been ascertained by the instrument, and the point, K, taken at pleasure; although if $\mathrm{JK}=10$ feet, the calculations will be simplified.

By similar triangles $\mathrm{FG} : \mathrm{FH} :: \mathrm{AB} : \mathrm{AH} = \frac{\mathrm{FH}\times\mathrm{AB}}{\mathrm{FG}} = \frac{asx}{a} = sx.$

$$\text{Again; } \mathrm{AH}=\mathrm{AE}+\mathrm{EF}+\mathrm{FH}=gx+h+as,$$

$$\text{and since } \mathrm{AH}, \text{ also}=sx \;\therefore\; sx=gx+h+as,$$

$$\text{from which, } sx-gx=h+as=(s-g)x,$$

$$\text{and } x=\frac{h+as}{s-g}.$$

$$\text{For the other side, } \mathrm{DH}=\mathrm{CD}.s=sy.$$

$$\mathrm{ED}=\mathrm{CD}.g=gy. \quad \mathrm{EH}=\mathrm{ED}+\mathrm{DH}=gy+sy.$$

$$\text{Also, } \mathrm{EH}=\mathrm{EF}+\mathrm{FH}=h+as.$$

$$\therefore gy+sy=h+as=(g+s)\,y,$$

$$\text{and } y=\frac{h+as}{s+g}.$$

Which is identical with the former, excepting the change of the sign in the denominator. The quantities a and s, it will be observed, are *constant*, throughout all the sections of the same cutting, and hence the formula is quite simple.

Example.—Let $h=19{\cdot}65$, $a=10$, $\mathrm{FH}=as=7{\cdot}5$, hence $s=0{\cdot}75$. $\mathrm{JK}=10$, $\mathrm{JE}=2{\cdot}5$, hence $g=0{\cdot}25$.

$$\text{Then } \frac{h+as}{s-g}=x=\frac{19{\cdot}65+7{\cdot}5}{{\cdot}75-{\cdot}25}=\frac{27{\cdot}15}{{\cdot}5}=54{\cdot}3$$

$$\text{And } \frac{h+as}{s+g}=y=\frac{27{\cdot}15}{{\cdot}75+{\cdot}25}=27{\cdot}15.$$

$$\text{In corroboration; } \mathrm{AE}=xg=54{\cdot}3\times{\cdot}25=13{\cdot}575$$

$$\mathrm{AH}=\mathrm{AE}+\mathrm{EF}+\mathrm{FH}=13{\cdot}575+19{\cdot}65+7{\cdot}5=40{\cdot}725$$

$$\text{Also, } \mathrm{AH}=\mathrm{AB}.s=xs=54{\cdot}3\times{\cdot}75=40{\cdot}725.$$

And so for the other side, DH, is found $=20{\cdot}3625$.

By inverting the figure, its application to embankments will readily be seen.

New Motive Power.

The following extract from the *New York Tribune*, will be read by engineers with interest. We are assured by a friend in New York, competent to form a correct judgment, that the account of the experiments given therein is correct, and that an application is to be made on a scale sufficiently extended to test the practical value of bi-sulphuret of carbon as a motive power. Com. Pub.

An engine of small size, analogous to the steam engine in its structure and mode of operation, but producing considerable more power by the employment of a different fluid, the "bi-sulphuret of carbon," has been recently on exhibition in room No. 17, Bank of the Republic Building, in this City. Numerous and varied experiments seem to furnish indubitable proofs that this hitherto unimportant fluid (produced in any quantities by passing the vapor of sulphur through charcoal) possesses the long-sought quality of expanding into vapor of a given volume, and thus producing a given amount of mechanical power without the expenditure of as much heat as in generating the same quantity of steam. This is proved by working the engine alternately by steam and bi-sulphuret, (taking care to provide against any transfer of heat from one to the other,) and observing the power developed in either case with the same fire and the same boiler. The result is uniformly and unequivocally in favor of the new fluid, as worked in this particular engine and under these particular circumstances. A larger engine, rated at six horses power, is reported to have been for some time in operation in a distant portion of the State with the same results; but of this we cannot speak with the same degree of certainty. The engine now exhibiting is in the form of an ordinary horizontal stationary cylinder, 2¼ inches diameter, stroke of piston 4 inches. It is provided with a common short slide-valve like a locomotive, cutting off by the lap at about ⅞ stroke from the commencement. It is accompanied by an upright tubular boiler, heated by a spirit lamp; and the vapor, whether of water or bi-sulphuret of carbon, is finally condensed by passing through a worm or coiled pipe in a vessel of cold water. No vacuum is attained by this condensation, the only object being to preserve the material. Resistance is applied by means of a friction brake, and the feed-pump is provided with cocks, so that either water or bi-sulphuret alone, or a mixture of these fluids, may be forced into the boiler; and it is found that the engine works considerably more rapid, and with a greater load on the brake, when fed with the new fluid than when fed with water. *How much* gain results from this substitution would require more careful experiments and much more time than we have yet devoted to this subject; but the fact of the gain is established beyond a shadow of a doubt. After running for a reasonable time with increased power by the aid of the bi-sulphuret, the engine can be again worked with steam at the same rate as before without interruption of its motion, showing that the operation has been conducted without loss of the heat previously stored in the water. The bi-sulphuret being decidedly more volatile than water, much care is required to treasure the heat to this extent while working with the new fluid; but it was unequivocally done in one instance at our request.

A fluid which expands into vapor with smaller consumption of heat than water has long been sought after as a motive agent. After water or any other fluid has been heated to its boiling point, it requires a great addition of heat to expand it into vapor. Alcohol, ether, and other liquids expand into vapor of a greater or less volume than water, and absorb, in so doing, a proportionally greater or less quantum of heat, so that it has come to be acknowledged as a law that the volume of any vapor is proportional to the heat absorbed, and consequently that no gain could be derived from substituting other liquids for water. Two fluids have been proved, however, to be exceptions to this rule. These are mercury and carbonic acid. Both these are or might possibly be more economical of fuel than water for an engine, but both have proved impracticable; the first by reason of the high temperature required (boiling at 620° Fah.) and its effects on the health of those employed about it; the second by reason of the low temperature and great pressure required for its condensation, (boiling at a temperature below zero,) as well as by its effects on the metals of the engine and boiler. The present discovery, on the contrary, provides an agent boiling at 108° Fah. and capable of developing possibly a five or six fold power, as compared with steam, with no practical difficulties yet discoverable, except an unpleasant but harmless odor when allowed to evaporate in the air.

To prevent confusion, it may be well to distinguish between this principle and some of the other hopeful devices for economizing fuel. The caloric or air engines of Sterling, Ericsson, Wilcox, Bennett and others, do not attempt this method, but simply draw from the discharging pipe as large a quantity of its heat as possible, and transfer it to the receiving pipe. The compound engine of Du Trembley exhibited at the Novelty Iron Works, in this City, in 1852, and now running a French steamer on the Mediterranean, does not attempt this method, but extracts sufficient heat from the exhaust pipe of the steam engine to boil the ether at a lower temperature, and thus impel a second engine. The cloud engine of Storms does not attempt this plan, but by introducing air into the steam creates a fluid which operates more desirably than steam *after the "cut-off."* In engineering language, it is only more economical "when worked very expensively." The vapor of bi-sulphuret of carbon has not yet been tested at any high grade of expansion; but should it be found by experiment to follow the same law as steam, the practical value of the fluid for this purpose seems to be almost incalculable. The credit of the discovery or invention, belongs to Mr. B. Hughes, of Rochester, in this State, who obtained a patent for this application.

AMERICAN PATENTS.

List of American Patents which issued from June 5, to July 3, 1855, (inclusive,) with Exemplifications.

JUNE 5.

1. For an *Improvement in Registering Blocks for Printing Oil Cloths;* James Albro, Elizabethtown, New Jersey.

Claim.—"The bar of straight edge with T shaped stops attached permanently to it, in combination with the guide screws in the blocks, and the recess in the right hand corners of the blocks, and smooth surface on the faces of the blocks."

2. For an *Improvement in Seed Planters;* Lucien A. Butts, Cuba, N. Y.

Claim.—"Raising the seed to be planted up in a cup or cell, vertically or nearly so, above the height of the grain in the hopper, and then tripping a valve in the cup or cell, and allowing the seeds contained therein to drop through a tube towards the ground."

3. For *Improvements in Burning Brick;* Daniel Blocher and George M. Blocher, Cumberland, Maryland.

Claim.—"The furnaces entirely within the casement and fed at the top, in combination with the close setting of the interior benches, by which, placing the fuel within the arches is avoided, and the burning of the kiln improved."

4. For an *Improved Ship Ventilator;* Ernest Bahr, Rochester, Indiana.

Claim.—"The helical tube provided with valves and guard plates. One end of the helix terminating above the deck in two parts, D E, the part E being provided with a wire wheel and wire cloth covering, said part, E, being movable, so that it may be turned to face the wind at all times."

5. For an *Improvement in Feeding Water to Steam Boilers;* Thomas Champion, Washington, D. C.

Claim.—"My invention consists in placing a hollow tube or tubes within the interior of the boiler above the water line, made to suit the form of the boiler, having many small exit apertures or fissures made through it at short intervals, so directed as to sprinkle all the inner surface of the boiler that is bare of, or is likely to become bare of water, while fire is acting on the opposite sides of the plates. Also, supplying steam boilers with all their water through a sprinkler that is connected with the lower water space and feed pipe by a valve at their junction, which allows the water that passes up through the sprinkler to jet the plates when the pump is not acting, and so long as any water remains in the boiler above the fire or feed pipe."

6. For an *Improved Arrangement of Drains for Sewers;* P. J. Coogan, Charleston, S. C.

Claim.—"My invention consists in the employment of siphons placed within a box or receiver, whereby the sewer or channel which extends from the box or receiver to the main sewer, is prevented from being choked or stopped with sediment or impurities, and all unpleasant and unwholesome effluvia, arising therefrom, avoided. Also, the box or receiver provided with siphons."

7. For an *Improvement in Seed Planters;* Charles H. Dana, West Lebanon, N. H.

Claim.—"The arrangement of the hinged vibratory mouth piece at the lower end of the staff, with the projecting portion of the front side of the seed box, and with the incision plate descending therefrom, in such a manner, that the downward sliding movement of the said staff upon the seed box will close the said mouth piece upon the incision plate, and from an incising planting receptacle for depositing the seeds in the ground, and an upward sliding movement of the said staff upon the seed box, will force open the said mouth piece, and leave the seeds in the extreme bottom of the incision formed by the said planting receptacle. Also, the arrangement by which I positively insure the opening of the mouth piece of the planting receptacle at each upward movement of the handle, viz: by means of the projecting portion of the plate which is secured to the seed box (or its equivalent)."

8. For an *Improvement in Washing Machines;* Lewis W. Colver, Louisville, Ky.

Claim.—"The washing of clothes by placing them in a crate, basket, or creel, which has a reciprocating motion through the suds or wash box, and, at the same time, a rotary motion around its own axis, by which means, the position of the clothes is constantly changing whilst they are forced through the water, and are washed without being rubbed or injured."

9. For an *Improvement in the Soak Pits of Brick Machines;* William H. Degges, Washington, D. C.

Claim.—"The revolving soak pit, or its equivalent, for uniformly soaking the clay when pulverized, and conveying it to a convenient position to be fed into the brick machine."

10. For an *Improvement in Brick Machines;* Wm. H. Degges, Washington, D. C.

Claim.—"1st, Causing the reciprocating bar to rest at each end of its travel, whereby ample time is afforded for inserting the moulds under the bottom of the pug mill, and for passing the clay into them while in their rest position. 2d, Inserting the moulds immediately under the centre of the pug mill, whence they are moved alternately to the right and left previous to being filled, whereby the size of the pug mill and the power required to work it, are economized to the fullest extent. 3d, Dusting the endless apron, or other device, for conveying the clay to the pug mill, with a mixture of coal dust and sand, whereby the clay is prevented from adhering thereto, and, at the same time, the coal dust is evenly mixed with the clay during its preparation. 4th, The series of brushes, or other device substantially the same, that will hold water, whereby the moulds are both cleansed and damped at the same time."

11. For an *Improvement in Reaping and Mowing Machines;* Andrew Dietz and John G. Dunham, Raritan, New Jersey.

Claim.—"Our present invention is generally similar to our former invention, and for which letters patent were granted to us bearing date 27th March, 1855, but greatly simplifies our said former invention, and also much increases the effective power of the mower or reaper, friction lessened, and the draft rendered easier. Also, the use, for the purpose of transferring motion from the driving wheel to the cutter bar of a short lever, the centre of oscillation of which is over the cam flanch itself, the rollers being but a cam and a half apart, or its equivalent."

12. For an *Improved Mode of Securing Wash-Boards to Walls;* Thomas Estlack, Philadelphia, Pennsylvania.

Claim.—"Securing wash-boards to the flooring and to slides, which work in guides attached to the walls, or in an equivalent way, so that the wash-boards will, in case of the shrinking or settling of the flooring, fall, or settle with it, thereby causing the lower edges of the wash-boards and flooring to be at all times in contact."

13. For a *Method of Composing Music;* William Fischer, Philadelphia, Pa.

Claim.—"So arranging a certain number of musical phrases on each of a number of cards, that by selecting and combining one from each card, a number of musical and perfectly melodious pieces can be composed, all of them differing from each other."

14 For an *Improvement in Boot Jacks;* Franklin J. French, Whitingham, Vermont.

Claim.—"The spring wedge in combination with the lever and spring, or their equivalents."

15. For an *Improved Machine for Skiving Boot and Shoe Counters;* Luther Hill, Stoneham, Massachusetts.

Claim.—"Combining with the rotary cylinder bed or carrier its face, clamp, and arc cutter, the peripheral clamp and its cutter, the whole being arranged and made to operate so as to perform the function of beveling along the arc of one counter and the chord of another during one revolution of the said cylinder bed. Also, combining the arc knife or cutter, the cylindrical bed or carrier, and the clamp thereof, by means of mechanism, in order that such arc knife or cutter may adapt itself to a leather counter of any ordinary thickness held between the clamp and the plane surface of the cylindric bed, such means or mechanism being the rocker frame and the adjusting lever. Also, supporting the bifurcated or rocker frame by means of a rotary journal or clamp, or the equivalent thereof, so that the angular position of the knife with respect to the plane surface of the rotary carrier may be changed as circumstances may require."

16. For *Improvements in Grain and Grass Harvesters;* M. G. Hubbard, City of N. Y.

"My improvements consist in the direct connexion between the driving wheel and cutters, by means of a single shaft, the combinations and bracings of the driving parts with the frame, and the mode of forming the cutter bar, and affixing the cutters thereto, together with the form and construction of the cutter bar, and its connexion with the frame."

Claim.—"The employment of two fingers to each sickle blade, for the purpose of dividing the cutting force expended at each stroke of the cutter bar, and, also, preserving, more perfectly, the cutters from injury, by keeping stones, &c., from coming in contact therewith. I do not claim the general device of making bars of angle iron for the purpose of lightness and rigidity, but the making the cutter bar of angle iron for the purpose of attaining, at the same time, both the above advantages, and a shoulder against which to abut the knives, so that a single bolt to each will securely hold them."

17. For an *Improvement in the Process of Manufacturing Hats;* Lausing E. Hopkins, Brooklyn, New York.

"The nature of the invention consists in providing a new process of forming a bat, or hat body, a new process of bringing the same into a proper size, and a new process of sticking, scalding-in and beating up the nap of hats, the whole forming a complete plan of making hats, from blowing the fur to finishing the napped hat ready for dyeing, by means of a series of machines adapted to the purpose, making up a full process of manufacturing hats, whether fur or other material of suitable character be used, and, further, whether it is desired to make napped fur hats, felt hats, or the shell for bodies for plush hats."

Claim.—"The making a complete hat body by means of the manipulations and process described, including the forming, felting, or sizing, and the sticking, scalding-in, and beating-up of nap, without regard to the peculiar machinery which may be used to produce the combined result of beating, or otherwise manipulating in hot water, for the purpose of manufacturing a hat by a complete and continuous range of mechanical operations as a substitute for the dipping and rubbing on a plank by hand."

18. For an *Improvement in Floating Cabins for Steam and other Vessels;* Wm. R. Jackson, Baltimore, Maryland.

Claim.—"The construction of a deck or saloon cabin of a steam or other vessel, so that it shall admit of being separated from the hull, and form in itself an escape or life boat."

19. For a *Double Acting Pump;* Edwin A. Jeffery, Corning, New York.

Claim.—"Connecting the piston heads by a long tube having a short valve chamber near its middle with a single ball valve, the water passing alternately through each end of the tube and out at the sides of said valve chamber, the valve chamber being so short that the ball will exclude the water from one end by rolling only far enough to admit the water fairly at the other, while the piston heads are so far apart that the eduction port shall always be embraced between them."

20. For an *Improvement in Apparatus for Bleaching Rags;* Harrison Loring, Boston, Massachusetts.

"The nature of the invention consists in so arranging the induction pipe as to allow of the expansion and contraction of the bleach without affecting it. Also, the admitting of steam to all parts of the bleach at the same moment, which I effect by means of perforated pipes running lengthwise of the bleach; this prevents the rags from being forced compactly into one end of the bleach, (as they are when steam is admitted directly at any one point, as has been done heretofore,) and allows, by the equal distribution of the rags, the bleaching liquor more thoroughly to perform its functions. Also, in introducing the induction pipe through the journal of a revolving bleach, securing it in a fixed position, and allowing the bleach to revolve around it, making the connexion steam tight by packing, in the same manner as the piston rod to a steam engine, by means of a stuffing box and glands, thus avoiding the friction and liability to leakage occasioned by the present method of connecting the pipes by butting the end of the pipe against the end of the journal, which soon insures a leakage by the unequal wearing away of the surfaces in contact."

Claim.—"The manner of introducing the steam to all parts of the revolving bleach at the same moment, by means of a perforated pipe attached to the interior of the bleach, the adjacent ends of which are connected by a socket joint to a stationary induction pipe, arranged so as to allow of the expansion, contraction, and movement of the bleach without derangement."

21. For an *Improvement in Fastenings for Carpets;* William S. Loughborough, Rochester, New York.

Claim.—"Securing the edge of the carpet by means of a button fixed to the floor and turning upon an inclined axis, so as to be self-clamping."

22. For an *Improvement in Hydro-Carbon Vapor Apparatus;* Samuel F. McDougall, Brooklyn, New York.

Claim.—"The double gas pipe for conveying hot air or steam around the pipes to prevent condensing, or any other substantially the same, and which will produce the intended effect."

23. For an *Improved Brace for Supporting Garments;* Daniel Minthorn, City of N. Y.

Claim.—"The arrangement of straps, forming a suspender for the use of ladies or gentlemen, by which the hips are relieved of the weight of the lower garments, which are sustained by the shoulder straps, at the same time leaving the regions of the lower ribs and viscera perfectly free in their action. Also, in combination with the above suspender, the short corset, by which the weight of the skirts is employed to raise and adjust the breasts, and by tightening or loosening which, the said weight is more or less transferred from the shoulders to the breast. Also, the straps attached to the boot or stockings."

24. For an *Improvement in Wagon Wheels;* Sylvanus Perkins, Pittsburgh, Pa.

"The nature of the invention consists in making wagon wheels by combining and arranging a male and female hub, each armed with spokes, the female hub being movable, the spokes in the female hub to arch or dish towards the point of the male hub, and the spokes of the male hub to arch or dish towards its larger end."

Claim.—"The combination and arrangement of the male and female hubs, the spokes, the rib, the tire, the box, and the nuts."

25. For an *Improvement in the Manufacture of Hats;* Andrew Rankin, Newark, N. J.

Claim.—"The employment of the rider for controlling the action of the hands, and, in combination therewith, the upright lever with movable fulcrum for operating the same. Also, uniting the hand and cradle by cords, whereby the hats are readily raised out of water to be handled, and the cradle is held in place to receive a new set of rollers."

26. For an *Improved Portfolio;* Samuel J. H. Smith, Boston, Massachusetts.

Claim.—"Combining a bill or paper file composed of two straight bars or plates and elastic bands united together at their ends, when such bars or plates are so arranged that one may be parallel and above the other, with two covers and a flexible elastic or extension back, so as to constitute the file portfolio, for the retention and preservation of papers or letters, and protecting the mass or file of them on both sides and the back of the same."

27. For an *Improved Furnace for Warming Buildings;* George S. G. Spence, Boston, Massachusetts.

Claim.—"So arranging and combining the exit tube within the reverberating dome and smoke chamber, and with respect to the fire place thereof, that the smoke and gases reverberated from the dome, may not only pass towards the exit tube in convergent streams, but be deflected towards and against the fuel or flame thereof before they may escape into the lower end or mouth of the tube; my improvement being productive of a more perfect combination of the said volatile products than takes place when the exit tube is surrounded by another tube or case, which separates the descending gaseous currents from the fire before they escape into such tube. Also, so combining the valve and discharge tube, that the tube may be movable with the valve and pass through the valve opening, the valve thus serving to support the tube, and rendering unnecessary any arms or such like devices which would tend to collect soot and otherwise obstruct the draft through the valve opening."

28. For a *Bench Rest;* Joseph D. Spiller, Concord, New Hampshire.

Claim.—"Combining with a bench rest, mechanism, for not only elevating said rest with an intermittent rotary motion during successive pressure on a spring thumb slide applied to said bench rest, but for enabling said bench rest to be moved downward whenever necessary. Also, combining with the serrated top plate of the bench rest a plain slide plate."

29. For an *Improvement in Machines for Kneading Clay;* Harlow H. Thayer, Sandwich, Massachusetts.

Claim.—"The employment of the inverted conical chamber provided with a screw or perforated plate, which has its apertures of taper form, said chamber having a plunger working in its upper cylindrical portion. Also, the press chamber in combination with the reciprocating fork for cutting off the clay discharged from the press chamber."

30. For an *Improvement in the Manufacture of Ornamental Felt Cloth;* O. B. Tomlinson, Athens, Pennsylvania.

Claim.—"The manufacture of ornamental felt fabrics by placing colored wool, fur, or any other shrinking substance upon the surface of a sheet of batting, and shrinking the same colored wool, &c., into the body of the felt, to form an ornamental felt fabric."

31. For an *Improvement in Steam Engine Regulators;* Henry Webster, Beetown, Wis.

"The nature of the invention consists of a float placed within a vessel which is kept constantly supplied with water by a small pump or pumps driven by the engine, and which is provided with a suitable aperture from which there is a constant escape regulated by a valve. The float is connected with a throttle valve cut-off. When the engine continues to run at the desired velocity, the water escapes from the vessel as fast as it is pumped in, but if the speed of the engine increases, the water is pumped in faster than it can escape, and the float rises, and by its action on the throttle or cut-off causes the supply of steam to be diminished, or, if necessary, stopped altogether; and if the speed of the engine diminishes, the level of the water in the vessel falls and with it the float, thus acting on the throttle or cut-off to increase the supply of steam."

Claim.—"Controlling the escape of the water by the flap valve and the rod with its inclined piece."

32. For an *Improvement in Gas Regulators;* Hiram Wheelock, Boston, Mass.

Claim.—"The use of textile or fibrous substances for packing the chamber of a gas regulator."

33. For an *Improved Melodeon;* Wm. C. Whipple and Wm. C. Bowe, Westville, Conn.

Claim.—"The use of two sets of levers located in the wind chest under the valves, and so connected as to enable us to play any desired tune and its octave."

34. For *Improvements in Looms;* Wm. Whiteside and John Shinn, Philadelphia, Pa.

Claim.—"1st, The combination and arrangement of one lever at the bottom of the loom with one at the top, in such a manner as to control any number of levers of harness that may be desirable, and open the warp-shed evenly both ways. 2d, The combination of the guides, traveling rods, the rollers, and straps connecting the levers, for the purpose of bringing the hooks to their proper place in time to be ready for the next movement of the pattern roller. 3d, The vertical levers in combination with the wires for the purpose of actuating the hooks. 4th, The combination of the swinging plates with the levers, or the equivalent arrangement of the same, for the purpose of actuating the pickers. 5th, The rod G, or its equivalent, so arranged with the rod I, that when the shuttle is arrested in front of the reed, it will cause the protecting finger to strike the lever and shift the driving strap and immediately arrest the further advance of the lay. 6th, The following as an improvement on the machine of E. Burt, dated June 20, 1845, in which the said E. Burt claims the hanging weft protector on the race of the lay itself. The balance catch in combination with the loop and operated by the swell, so that when the weft thread is broken or exhausted, it will immediately arrest the motion of the loom in the first forward motion of the lay."

35. For *Improvements in Boot Crimping Machines;* George W. Zeigler, Tiffin, Ohio.

"The nature of the invention consists in so constructing and arranging the devices which operate the crimping iron as to carry it in between the jaws with a compound motion. Also, in corrugating the jaws, so as to work the leather away from the angle of the crimping iron and into the foot and leg of the boot."

Claim.—"1st, The segment, gear, and rack, or their equivalents, in combination with the slots, or their equivalents, for the purpose of giving to the plate the motion. 2d, Corrugating the jaws of boot crimping machines, (as in the nature of the invention)."

36. For an *Improvement in Ring Spinning Frames;* Wm. Darker, Jr., Assignor to J. B. Thompson, Philadelphia, Pennsylvania.

Claim.—"1st, The method of applying the rings to enable them to receive rotary motion, that is to say, attaching them to the top of metal sockets, which are large enough to receive the bobbins, and are secured to tubes, which revolve easily upon the spindles. 2d, The method of attaching the bobbin to the spindle by a ball which drops in a slot at the top of the spindle, whereby the bobbin is properly secured, and the tube is allowed to be of proper length to steady the ring without interfering with the bobbin."

37. For an *Improvement in Wrought Iron Beams and Girders;* Anthony Pollak, Philadelphia, Pennsylvania.

Claim.—"The combination in wrought or malleable iron beams or girders of top and bottom T pieces, with flat or plane surfaced longitudinal plates riveted upon both sides of the stems or vertical portions thereof."

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38. For a *Filter;* Thos. C. Clarke, Camden, New Jersey.

Claim.—"The application of the spring, so that it shall, in connexion with the pressure of the incoming stream of water, work the upper and lower valves, always leaving the lower valve open for the passage of sediment after the running of the water ceases, thus forming a self-cleansing filter, which cleansing is further promoted by the facility with which the filtering medium itself is changed and renewed by unscrewing the lid in which the filtering medium is secured."

39. For a *Hydrant Filter;* Thos. C. Clarke, Camden, New Jersey.

Claim.—"The combination of the filtering chamber, the rod and the valves, whereby the simple operation of starting the water brings into operation the filter, and the stopping off the water opens the escape for the sediment."

40. For a *Feed Motion for Saw Mills, &c.;* Chas. M. Day, City of New York.

Claim.—"The clamps attached to a lever and working upon a pulley, in combination with the rack and pinion attached to the arm. Also, the levers attached to the pivots of the clamps and connected by the pin and slot at their inner ends, for the purpose of relieving the clamps from the pulley when the carriage is gigged back."

41. For an *Improvement in Mill Bushes;* George L. Dulany, Mount Jackson, Va.

Claim.—"The wedge cheeks, movable disk, and self-acting wedge, or their equivalents."

42. For an *Improvement in Buoys for Raising Sunken Vessels;* Elisha Fitzgerald, City of New York.

Claim.—"The attachment to the air bag of an escape valve to prevent its bursting, when, in consequence of the rising of the sunken ship, the pressure of the water around the bag is partially relieved."

43. For an *Improvement in Supplying Furnaces with Hot Air;* Calvin Fletcher, Cincinnati, Ohio.

Claim.—"The arrangement of the fan steam tubes, together with the inlet passages for steam and cold air, and the discharge of hot air and water of condensation."

44. For an *Improvement in Window Sashes;* Wm. S. Ford, City of New York.

Claim.—"Constructing folding, hinged, or French windows, so that the hinged sashes may be raised and lowered the same as the ordinary sliding sashes, and, also, be allowed to swing as French sashes, whereby said sashes are kept closed without the application of any special fastening, and also rendered perfectly weather proof."

45. For an *Improvement in Fastening Scythes to Snaths;* William P. Greenleaf, Washington, New Hampshire.

Claim.—"The mode of fastening scythes to snaths by the employment of the ferrule at the end of the snath, the bolt, the nut, the notch in the shank of the scythe, the toe or claw of the scythe, and the perforated plate."

46. For an *Improvement in Bedsteads;* Florian Hess, Cincinnati, Ohio.

Claim.—"The four levers attached to the inside of the posts in combination with the diagonal rods and plate connected with the screw, all for the purpose of holding the side and end rails of the bedstead firmly to the posts."

47. For a *Machine for Planing Staves;* M. T. Kennedy, Fallston, Pennsylvania.

Claim.—"The combination of the disk and clamp, the clamp being formed of a series of rods passing through the disks and provided with springs and lips."

48. For a *Machine for Jointing Staves;* M. T. Kennedy, Fallston, Pennsylvania.

Claim.—"The combination of the reciprocating planes and clamp."

49. For an *Improvement in Door Locks;* John C. Kline, Pittsburgh, Pa.

Claim.—"The inclined or oblique faces and notch of the bolt, in connexion with and operated by the key tumbler."

50. For an *Improvement in the Arrangement of Bumpers for Self-Acting Car Brakes;* James J. McComb, New Orleans, La.

Claim.—"Allowing the brake beams of each car to abut against the car or platform of the car next to it, by which means I make available the whole play or distance between the cars in bringing up the brakes, and thus more effectually apply them than heretofore."

51. For an *Improvement in Revolving Fire Arms;* Fredk. Newbury, Albany, N. Y.

Claim.—"The construction and use of a guard to prevent the fragments of exploded priming caps from impeding the rotation of the cylinder by covering up the cones with a movable metallic ring, containing for each cone a chamber as large as can be conveniently made within the ring to enclose each cone; each chamber having an aperture to permit the priming cap to pass through, and, also, having lateral openings to pass off the gas produced by the detonation of the cap."

52. For a *Sawing Machine;* Isaac M. Newcomb, Eden, Vermont.

Claim.—"The bar secured to the arms of the vibrating frame by a hinge joint and its connexion with the saw shaft. Also, the guide arms of the carriage. Also, the lifting arm and catch rod, combined with the hook of the saw shaft, the oblique tongue and notched slide."

53. For an *Improvement in Propellers;* Joseph H. Penny and Thomas B. Rogers, City of New York.

Claim.—"The arrangement of the connecting rods with the connecting heads and the paddles, the connecting rods passing through the connecting heads, and the paddles being bolted to such rods, so that any one or more can be removed, if necessary, without interfering with the others, the whole being strong, and at the same time of light construction."

54. For an *Improvement in Cutting Clay into Bricks;* John Plumbe, San Francisco, California.

Claim.—"The mode of forming bricks, or their equivalent, by means of wires, or the equivalent, cutting upwards, irrespective of the manner in which the clay is prepared and placed in the mould frame."

55. For a *Method of Tuning Accordeons;* Edgar A. Robbins, Rochester, N. Y.

Claim.—"Such mode of tuning the reeds of accordeons and flutinas as will require but four modes or forms of fingering to perform twelve scales, any number of octaves within the compass of the instrument."

56. For an *Improved Stave Machine;* George H. Swan, Bridgeport, Conn.

Claim.—"Chamfering, beveling, and howeling barrels, kegs, &c., in fact, any thing requiring a croze, chamber, howel, or bevel, by means of two levers operated upon by springs and gauging or connecting rod, in such a manner, as to gauge the work, from the outside of the cask being round, or not working exactly to the shape of the head truss hoop, with any kind of croze, knives or saws, necessary to give the desired croze or groove, chamfer, or bevel, howel, and bevel, and the two levers are attached to the slide by pin or bolt acting on one or separate centres, and that slide made fast to the arm of the thumb or set screw at any point from the shaft, or doing away with the slide, and putting the pin or bolt directly through the arm at any point from the shaft required, consequently, adjustable to any size."

57. For an *Improvement in Sheet Metal Folding Machines;* Orson W. Stow, Plantsville, Connecticut.

Claim.—"Effecting the simultaneous action of the two folding bars, by so connecting or driving them, that, upon operation being given to the one folding bar, the other folding bar is set in corresponding action or motion thereby, whereby the folding plate is relieved from unequal and varying strain or pressure on its one side or face, the two "folding bars" are necessitated to act in unison, and the one operative lever serves to set both "folding bars" in motion."

58 For an *Improved Faucet;* Edward A. Sterry, Norwich Town, Connecticut.

Claim.—"The arrangement of the valve, the set screw, the grooved shank, and the screw enlargement of the spindle of the key with each other, and with the female screw in the sides of the chamber, and the groove which cuts through the threads of said screw, by which, in a cock of the usual proportions, the valve can be moved up and down without being turned on its axis."

59. For an *Improved Coupling for Organs and Melodeons;* Henry W. Smith, Boston, Massachusetts.

Claim.—"The combination of the lever with the shoulder on the valve rod."

60. For an *Improved Tenoning Machine;* Christopher Sharps and G. E. Adriance, Hector, New York.

Claim.—"The arrangement and combination of the two planes and cutters for cutting the tenon, rest, for supporting the spoke; drop, for keeping it down upon the rest while the tenon is being cut, and guide-box having a mouth and discharge. Also, the combination and arrangement of the plane stocks with planes arranged, so as to move in and out, slotted springs, to allow for said movements; spring and treadle, for causing said expansion."

61. For an *Improvement in Door Locks;* Joseph C. Silvy, New Orleans, La.

Claim.—"The circular or solid circular bolts, one-half in the lock and the other half in the catch. Also, the extension key, to lengthen or close the tumblers by means of a screw or slide, together with a scale to regulate the sliding bolt or bolts in the lock."

62. For an *Improvement in Guard Rails of Railroads, to be used with Pronged Cow Catchers;* Hosea D. Searles, Rockford, Illinois.

Claim.—"The combination of elevated guard ribs with the track, when the same are so arranged, that the prongs of the cow catcher of the locomotive may run between them."

63. For an *Improvement in Plank Roofs for Buildings;* Samuel Taylor, Petersham, Massachusetts.

Claim.—"Making each of the boards of a saddle form, in order that when laid together, their contiguous plane surfaces may not only be in close contact, whereby they will add greatly to the stability and efficiency of the roof, but be so inclined as to prevent water from remaining between them and causing or promoting their decay. Also, the improvement of providing each of the grooves of the upper boards with an inverted metallic or water tight lining or trough, for the purpose of protecting the joint directly under the same when the board becomes cracked or split."

64. For *Improvements in Heating Wrought Iron Wheels for Forging;* William R. Thompson, Cleveland, Ohio.

Claim.—"The method of heating hubs for wrought iron wheels, viz: by a peculiar arranged furnace, which causes the heat to pass around and through the centre of the hub from above and below, alternately, as may be required, and when heated to a sufficient degree, the sections are welded into a solid hub by the compressing and swedging action of dies conforming to the shape of the hub and spokes."

65. For a *Portable Floating Filter;* Nathan Waterman, Boston, Mass.

Claim.—"A portable floating water filter, wherein the water is filtered from the outside into the inside under an uniform pressure, regardless of the quantity of water in the filter."

66. For an *Improved Curvilinear Sawing Machine;* Shelden Warner, Enfield, Mass.

Claim.—"Placing the saws in frames, which are allowed to move laterally in the saw frame or sash, and having said saws so attached to the frames, as to be allowed to turn therein, said saws being turned by means of the rods *k*, *n*, attached to transverse bars on the vertical rods, *f;* the rods, *f*, being turned by the rods *n* and levers, the outer ends of the rods bearing against the pattern and operated as said pattern moves. Also, straining and attaching the saws to the frames by having bows attached to the ends of the saws and screws passing through them, the ends of said screws resting upon the top and bottom strips of the frames."

67. For an *Improvement in Artificial Fuel;* Wm. D. Beaumont, Mobile, Alabama.

Claim.—"The manufacture of a new article of fuel, composed of coal screenings, clay, or marl, fine straw or litter, crude turpentine, and gypsum, or their equivalents."

68. For an *Improvement in Soda Water Generators;* Wm. Gee, City of New York.

Claim.—"The construction of a soda water generator, having the heads connected to the cylinder by a single bolt, which shall also serve as a shaft for the agitator to revolve upon."

69. For an *Improvement in the Buckets of Paddle Wheels;* Augustus M. Glover, Waterborough, South Carolina.

Claim.—"A plane concave to the paddle, that all the advantage of the concave is secured without loss of hold upon the water and slip in backing vessels propelled by wheels."

70. For an *Improved Self-Acting Cotton Press;* Jonathan Grout, Hocking City, O.

Claim.—"The construction of a press, designed for the general purposes of a press, so arranged as to swing freely about an axis of motion, and having a lever or set of levers with their fulcrums within the said axis of motion, so that when the press is swung out in one direction, the said levers are brought into such a position, relative to the other parts, that they take hold of the beam and thrust it down as the press is swung back to its former position, and in a manner which allows the operation to be repeated until the degree of pressure desired is attained."

71. For an *Improvement in Pressing Tobacco in Plugs;* George King, Farmville, Va.

Claim.—"I claim the box and plunger, when arranged and operated, so that both the box and plunger have a reciprocating motion, for the purpose of allowing the tobacco to be fed into the box, and also compressed therein. Also, the combination of the box and plunger with the hopper and slide."

72. For an *Improvement in Wheat Fans;* Joseph Montgomery, Lancaster, Pa., and James Montgomery, Baltimore, Maryland.

Claim.—"Constructing the screw box with the addition of a plate or apron under its upper screw, for conveying whatever passes through said screen to the front part of the box, and of a fine screen at the bottom for separating sand or grit from the small grain and seeds caught therein, in combination with a box, or its equivalent, beneath, for collecting or conveying away the sand or grit thereby separated. Also, adding an adjustable board or shelf in the front part of the shoe, so situated, that light and bulky impurities blown from the apron may be caught thereon and conveyed out of the shoe, whilst sufficient space is left behind and below it for the whole extent of screw beneath to be employed to receive the grain."

73. For an *Improved Machine for Cutting the Edges of Boot and Shoe Soles;* Jean Pierre Molliere, Lyons, France; patented in France, January 5th, 1855.

Claim.—"Cutting down or paring and sawing of the edges of the soles and heels of boots and shoes, by means of the circular tools revolving upon horizontal, vertical, or angular axes."

74. For an *Improvement in Sewing Machines;* T. J. W. Robertson, City of N. Y.

Claim.—"Making a needle thread single or chain stitch, by means of a detached and loosely held looper and reciprocating needle, arranged and operating together in such a manner, that while the needle in its back stroke draws the slack of its thread on to, or along and around the looper, the looper without detaining the loop formed by the drawing of the slack of the needle thread on and along it, guides and keeps the loops open, and the needle and its thread in their next advance stroke pass through the open loop, which, kept moving and having the further feed of its own, or needle thread passed through it, is drawn entirely over and off the looper to complete the stitch."

75. For an *Improvement in Sewing Machines;* Isaac M. Singer, City of New York.

Claim.—"Feeding the cloth or other substance in sewing machines by means of a wheel hung on a vibrating lever, or equivalent thereof, and borne upward by a spring, or its equivalent, against the under surface of and in combination with a fixed pad above."

76. For an *Improved Wind-Mill;* Chas. R Webb, Philadelphia, Pa.

Claim.—"Placing the two cog wheels in the head of the mill, so that they shall gear into each other in centre thereof, and bringing down the power from said wheels by an oblique shaft, whose foot or bearing is vertically beneath the teeth in contact in the head of the mill."

77. For an *Improved Serpentine Spinner to Catch Fish;* Chas. DeSaxe, Assignor to Thos. H. Bate, City of New York.

Claim.—"A spinner constructed of a piece of metal twisted or coiled upon its edge, and then attached to and winding about a hook or other piece of tackle."

78. For an *Improvement in Printing Presses;* Joel G. Northrup, Assignor to James D. Mather, Syracuse, New York.

Claim.—"The manner of giving motion to the bed of a printing press, viz: by means of a vibrating connecting rod, one end of which is attached by a stud pin or wrist to a stand that projects from the lower side of the bed, the other end being connected by a similar wrist to an endless chain which passes around two wheels which revolve, thus producing an elongated crank motion. Also, the manner of attaching, combining, and communicating its motion to the bed."

79. For a *Metallic Medium for Filtering;* Orson C. Phelps, Assignor to self and John Holton, Boston, Mass.

Claim.—"The use of disks of rolled wire gauze prepared and applied to the filter."

80. For a *Machine for Ruling Leather;* Joshua Turner, Jr., Charlestown, Assignor to Asa Bennet, Boston, and Warren Covell, Dedham, Mass.

Claim.—"The improved manner of combining each of the striping wheels of the machine with its movable bed and inking or coloring roller, the same consisting in applying said striping wheel to its shaft, in such manner as to enable it to rotate on the same and to play freely thereon in any direction in a plane perpendicularly thereto, and to such extent as to accommodate itself to the changes in the surface of the leather, or article to be striped, and, at the same time, keep in close contact with its coloring roller or cylinder. Also, combining with the series of striping wheels arranged together and on a shaft, a mechanism for raising and maintaining either one or more of them out of action with the surface to be striped and the coloring roller during the movement of the remainder of such wheels and the bed and surface to be striped under them, such mechanism being a cross bar or frame and its set of suspension hooks. Also, combining with the series of striping wheels and the bed, a mechanism, not only for raising said wheels from a skin resting on the bed, and after it has been striped by them, but for maintaining them entirely off the skin during the backward movement of it and the bed, the said mechanism being a rocker arm, with its weight, the catch or latch, the lifter, and the projection as applied to either one or both ends of the shaft. Also, combining with a series of striping wheels a spout or receiver, and peripheral and side or edge scrapers operating with respect to the spout and wheels."

81. For an *Improvement in Machines for Cutting out Boot and Shoe Soles;* Caleb H. Griffin, Assignor to self and Geo. W. Otis, Lynn, Mass.

Claim.—"The combination of the depresser bar with the reciprocating knife frame, its two movable knives and their elevating springs, or equivalent machinery, arranged and made to operate together. Also, the combination of mechanism for imparting to the knife frame its intermittent reciprocating movements, the said combination consisting of the two momentum levers, the barrel on the driving shaft, and the two sets of connecting straps, the same being applied to the carriage and shaft."

82. For an *Improvement in Attaching Gutta Percha Soles to Boots and Shoes;* John M. Wimley, Assignor to J. A. B. Shaw, Philadelphia, Pa.

Claim.—"Manufacturing or making boots and shoes with the outer soles made entirely of gutta percha, when the said outer soles are simultaneously formed and united to the 'upper' and 'insole' by means of heat and pressure in a mould."

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83. For an *Improvement in Stone Sawing Machines;* Joseph Adams, Fairhaven, Vt.

Claim.—"The application to the saw frame, hanging from cords, so as to move, of necessity, in the arc of a circle, of the counterbalancing weight, which at the same time permits it to feed itself at all parts of its motion."

84. For an *Improvement in two Motion Cone Valves;* Horatio Allen, City of N. Y.

Claim.—"So constructing a cone valve that in the operations of opening and closing the same, two motions shall be imparted to it, in or nearly in succession, and in directions at a right angle with each other; the first of said motions effecting the withdrawal of said valve out of contact with its seat, and retaining it so withdrawn, while the second motion shall be given, whereby it can, by that second motion, be turned without friction against the seat."

85. For an *Improved Machine for Cutting Irregular Forms;* Avery Babbett, Auburn, New York.

"By this machine a great variety of angular irregular forms may be produced, by simply changing the form of the cutters or knives and varying the setting of the indices."

Claim.—"The machine for the purpose of producing angular irregular forms."

86. For an *Improvement in Corn Planters;* Uriah Beebe, Oakland, Michigan.

"The nature of this invention consists in a new and improved mode of planting in check rows, by means of shafts and supports attached to the planters, which act as levers to raise the wheels to enable the driver while seated to adjust the planters, and which also act as covers to complete the process of planting."

Claim.—"The shafts and supports."

87. For an *Improved Reciprocating Railway Propeller;* Henry Boynton, Hinesburgh, Vermont.

Claim.—"1st, The double wheeled oar truck, provided with wheels rotating in opposite directions on the same axis and running between upper and under simultaneous acting railways, by which a longitudinal propeller for water craft is held or confined to its designed railways. 2d, In combination with two sets of railways, one for the forward and the other for the back stroke, the ascending and descending railways, so arranged that the fore wheels of the truck run upon one track and the after wheels upon another track, whereby the truck is free to ascend and descend at either end of the main railways in such a manner that a line drawn through its axles will be always parallel, or nearly so, to the main horizontal rails. 3d, The lower rising vibrating rails and the upper pivot moving rails. 4th, The combination of levers in their adaptation to railway propellers, by which the upper pivot rails at either end of the railways being moved by the truck wheels, those at the opposite end are similarly moved at the same time, and the addition of safety levers, by which if the pivot rails upon either side end are moved, all the others are similarly moved at the same time. 5th, The combination of levers, by which the catch bars or fastenings to the upper pivot rails are governed and disengaged by the truck wheels, and by which, if either one is disengaged, the others are also at the same time. Also, the combination of the curved toe rocking shaft, with the oscillating riding bar, sustaining a weight or spring with any reciprocating arm attached to the engine, for the purpose of gradually and rapidly retarding the piston and bringing it and the oar truck to a state of rest."

88. For an *Improvement in Railroad Car Seats;* John H. Cocke, Bremo, Va.

Claim.—"A back constructed with a rigid arm, the guide pins of which turn in a curved slot provided with a catch, while the back hinges upon the support for its lower edge. Also, in combination with a reclining reversable back, a concave seat, so that persons occupying the seat will not be liable to slide off as they would if the seat were flat or convex."

89. For an *Improvement in Apparatus for Replacing Railroad Cars upon the Track;* S. Park Coon, Milwaukie, Wisconsin.

Claim.—"The construction of a windlass, pulley, chain or rope, and foot stocks, in such manner as to adapt and attach them to a section or length of railroad rail, to form an apparatus that can be used for replacing railroad cars upon the track, and when this duty is done, the parts of which can easily be separated for more convenient transportation, and packed in the tool box of the tender or other appropriate receptacle."

90. For an *Improved Fish Hook;* Richard F. Cook, Troy, Alabama.

Claim.—"The combination and arrangement of the steel strips having baits formed on them, collar, or plate, rod, spiral spring, ring and bait hook."

91. For an *Improvement in Ploughs;* L. G. Evans, Spring Hill, Alabama.

Claim.—"Connecting and arranging the mould beam, land side, and cutter, in such a manner that they are together capable of a vertical and lateral adjustment in addition to the particular adjustment of the mould beam."

92. For an *Improved Coal Screen;* James P. Fennel, Philadelphia, Pennsylvania.

Claim.—"A portable coal screen composed of a tight box, within which are arranged a rotating screen and two drawers, the openings into which box, are provided with doors, so that the box shall remain tight when either or both the drawers are taken out."

93. For an *Improved Machine for Cutting the inside Hold of Shovel Handles;* George Fetter and Joseph L. Pennock, Holmesburg, Pa.

Claim.—"Cutting the inside hole of D shaped handles for shovels, spades, etc. by means of a curved cutter, so operated as to pass one half way round one end of the hold, the cutter smoothing or rounding a portion of said hold equal to its width, and then remaining stationary, while the handle is moved to force the remaining uncut portion of the hold past the cutter. Also, operating the cutter by means of the cam, frame, geared sector, and half cylinder, to which the cutter is attached. Also, operating the carriage to which the handle is attached by means of the cam and racks."

94. For an *Improvement in Springs for Hinges, &c.;* Arasmus French, Waterbury, Connecticut.

Claim.—"The method of composing a spring of a series of elastic rods, connected at each end to plates, or their equivalents, and at or nearly at equal distances from the centre of the plates, and surrounded at or nearly at the middle of their length, by a collar or ring, so that they shall be held nearer together at the middle than at the ends."

95. For an *Improvement in Scaffolds;* Abram C. Funston, Philadelphia, Pa.

Claim.—"Making the back upright of one or all of the sections or frames forming this particular scaffold in two parts, and providing the lower part with a slot, and uniting it to the upper part by a set screw which plays in the slot and allows of the lower part being raised."

96. For an *Improved Expanding Block for Horse Collars;* Robert R. Gray, Crawfordsville, Indiana.

Claim.—"The arrangement of the two sets of jaws, by which the inner jaws alone are actuated directly by the screw, while the outer jaws are actuated by the expansion of the inner, and the pressure of the springs, both jaws being guided by the slots."

97. For an *Improved Stump Machine;* Stephen Gordon and Francis Morris, Crawford County, Pennsylvania.

Claim.—"The construction of the machine, to wit: with a main shaft and wheels, with the larger wheel fastened on to the shaft, and the lesser wheel constructed so as to turn on the shaft."

98. For an *Improved Mode of Hanging Bells;* George W. Hildreth, Lockport, N. Y.

Claim.—"The round tapering shank and corresponding hole in the yoke, in combination with the bolt and cap to secure the bell firm into the yoke. Also, the doweling of the cap to the yoke, and the manner of securing the bolt from turning in the cap."

99. For an *Improvement in Doors;* Orvis C. Hill, Malone, New York.

Claim.—"Inserting springs and strips into grooves in the beveled top, bottom, or outer edge of a door, where the said door is made to fit into a casing, which is correspondingly beveled, by which the joints of the door are made wind and water proof."

100. For an *Improved Piano Forte Action;* Robert M. Kerrison, Philadelphia, Pa.

Claim.—"Solely the means I employ to check and hold the hammer after the blow; and as part of those means, the impeller. Also, the hammer butt, of a form suitable and proper to receive the action or pressure of two parts or branches of the impeller at two different points. Also, the impeller and the hammer butt, or their equivalents, acting conjointly as a means of checking and holding the hammer after a blow."

101. For an *Improved Hot Air Furnace;* John L. Kite, Philadelphia, Pennsylvania.

Claim.—"The combination of the castings with their vanes, and with the outside casing, for obtaining a great amount of heating surface at the expense of a small quantity of fuel."

102. For an *Apparatus for taking Stereoscopic Photographs;* Joseph H. Marston, Philadelphia, Pennsylvania.

Claim.—"The particular arrangement of two frames, or guides or boards, that shall work on and be fastened or pivoted on the camera board at the centre and front of the camera board, the frames or guides to be at right angles, so that when closed together they form the raised ledge parallel with each other by which to adjust and centre the angle board previous to setting the angles for stereoscoping. Also, the application of the spring to hold the frames together, the right and left screws and nuts and eye plates to force apart, and hold the frame in any desired angle. The above described apparatus is claimed, for moving the camera box and giving the true stereoscopic angle at one and the same time."

103. For an *Improvement in Fastenings for Carpets;* Felix Miller, City of N. York.

Claim.—"The method of laying and securing carpets down upon floors by means and use of the claw hook operating and combining with the carpet and eyelet on the floor."

104. For an *Improved Machine for Cutting Leather into Strips for Boot and Shoe Soles and Heels;* Jean Pierre Molliere, Lyons, France.

Claim.—"The cutting up of the sides of leather into sole or heel strips of any required breadth, by means of the self-arresting curved knife blade driven alternately to the right and to the left, by the Vaucanson chain, while the leather is held in its place against the adjustable pins by the spring ruler."

105. For an *Improved Method for Securing Cutters to Rotary Disks;* Jonah Newton, City of New York.

Claim.—"Securing the cutters to the disk or plate, viz: having the cutters of semicircular form, with ledges or projections on their back or convex sides, the ledges or projections being fitted in grooves in the semi-circular edges of the projections of the plate, the front or concave sides of the cutters having grooves in them to receive the nuts or segment heads, the projections, cutters, and nuts or heads, having screws passing through them for the purpose of allowing the cutters to be adjusted properly, and also securing firmly the cutters to the disk or plate."

106. For an *Improved Machine for Cutting Locks and Tapering ends of Wooden Hoops;* Royal Parce, Pitcher, New York.

Claim.—"The principle of cutting locks in wooden hoops by means of knives, or other cutting apparatus, having substantially the form of the lock required to be made, and cutting both transversely and longitudinally by the same movement."

107. For an *Improved Ice House;* W. D. Parker, City of New York.

Claim.—"The construction of the ice house, viz: having the ice house formed with double sides and double roof, with a suitable non-conducting substance packed between them, the house being provided with a slatted floor having an ice chamber underneath it, and also provided with a double inclined floor at its upper part, underneath which a screw is secured, on which charcoal and other absorbents are placed; a flooring, *l*, being placed on the flooring, *i*, and having holes or traps provided with doors made through it and also through the flooring *i*, also containing ice."

108. For an *Improved Machine for Manufacturing Wooden Ware;* David Pierce, Woodstock, Vermont.

Claim.—"The application and use of a cutter, or cutters in gangs, attached to a sliding rest, or their equivalent. Also, the apparatus for forming and finishing circular or elliptical heads or bottoms. Also, the apparatus for turning out the inside of the cylinders and cutting the croze."

109. For an *Improved Fan Blower;* David Pollock and J. R. Pollock, Lancaster, Pa.

Claim.—"Making the shaft hollow with open ends and with apertures in the sides within the blower casing, for the purpose of inducing a current of air through the shaft to keep it cool and at the same time to increase the supply to the fan. Also, making the pulley which receives the driving belt, hollow, with closed ends and a perforated face, and providing openings from its interior into the shaft, for the purpose of causing the displacement of the air between the belt and the face of the pulley, and at the same time increasing the supply to the fan."

110. For *Socket Handles for Chisels;* Lovell T. Richardson, Worcester, Mass.

Claim.—"Constructing the sockets with a die so formed that a transverse partition or ledge is left within the socket, said partition or ledge dividing the recess which receives the shank, so as to obtain a sufficient body or weight of metal at that part of the socket which is welded to the shank of the tool or implement, for the purpose of forming a strong and durable connexion of the socket and shank."

111. For an *Improvement in Producing Intermittent Acceleration of Motion in Harvester, Rakes, &c.;* John Richardson, Buckeystown, Maryland.

Claim.—"A device for producing an accelerated motion whether in rakes or for other purposes, said device consisting of the cam on the drum, and the ratch and pawl, and friction wheel."

112. For an *Improvement in Grain Cleaners;* Harrison D. Reynolds, Pendleton Ind.

Claim.—"The openings, in combination with the conductor and scouring cylinder."

113. For an *Improved Chuck for Turning Eccentrics;* John W. Russell, Springfield, Massachusetts.

Claim.—"The application of a chuck to irregular objects and points eccentric from the centre, using for that purpose the jaws and the screw in combination with the nuts or collars."

114. For an *Improvement in Seed Drills;* James Selby, Lancaster, Ohio.

Claim.—"Distributing the seed by means of the transverse slides, in combination with the reciprocating slides, operated by means of an adjustable crank formed by the sliding bar."

115. For an *Improved Apparatus for Moving Stereoscopic Pictures;* Albert S. Southworth and Josiah J. Hawes, Boston, Massachusetts.

Claim.—"Giving to the pictures of a stereoscope or other analogous instrument, a panoramic motion into and out of the fields of vision by means of mechanism, or by any other means equivalent thereto."

116. For an *Improvement in Rotary Engines;* Sylvester Stevens, Boston, Mass.

"The nature of this invention consists in dividing the cylinder into two separate and distinct chambers or cylinders, which are separated from each other by a revolving disk, to which are attached the two pistons, one for each cylinder. These two pistons, in lieu of being placed opposite each other, are set a short distance apart, so as not to receive their steam at the same instant, whereby the single disk, with its two pistons, is enabled to pass the dead centre as surely as where two cylinders with cranks set quartering are employed."

Claim.—"The revolving disk with its valves."

117. For an *Improved Self-Acting Brake for Vehicles;* Peter Ten Eyck, City of N. Y.

Claim.—"The employment of the shoes, attached to the back axle of the vehicle by the jointed arms or levers, where said shoes are connected to a sliding draft pole by rods and chain, said pole having a spring attached to it."

118. For an *Improved Self-Operating Circular Gate;* William Thompson, Nashville, Tennessee.

Claim.—"Constructing the gate of circular form, and having said gate rest upon a vibrating rail, which is connected to a platform or arranged in any proper way, so that said rail may be inclined either by the weight of the person, vehicle, or animal which is to pass through it, or by any other device, and cause the gate to roll down the depressed end of the rail, and consequently leave a free or open space between the posts, said gate closing or returning to its original position between the posts when the rail is relieved of the weight or pressure which first actuated it."

119. For an *Improved Brick;* Levi Till, Sandusky, Ohio.

Claim.—"The making of bricks with channels or grooves, and with spurs or conical projections."

120. For an *Improvement in Steam Boilers;* Charles F. Thomas, Taunton, Mass.

Claim.—"The improvement of extending the tube sheet, smoke tubes, and boiler, or its enclosing sheet, into the fire place and over the fire grate, in order not only that the part so extended may serve as a beam or strut to support the sheet against the superincumbent pressure of the steam, but that the flame and gases from the fire may not only pass against the tube sheet and enclosing sheet of the extended part of the boiler, but also through the extended parts of the tubes within such projected part of the boiler as specified, the same serving to greatly increase the extent of heating surface exposed to the fire."

121. For an *Improvement in Hose Couplings;* Albert M. Waterhouse, City of N. Y.

Claim.—"The slotted nut with the female screw on its inner surface. Also, the pipe with straight or vertical slots (one or more) and with a screw on its outer surface. Also, the combination of these parts, or their equivalents, each with the other, and all together, and all other combinations substantially the same."

122. For an *Improvement in Joints for Stove Pipes;* Alva Wordon, Ypsilanti, Mich.

Claim.—"The inclined tapering semi-circular grooves."

123. For an *Improvement in Joints of Pipes for Artesian Wells;* Jesse Norris Bolles, Philadelphia, Pennsylvania, Assignor to H. J. Ockerhausen, Baltimore, Md.

Claim.—"The mode of rendering cylinders or tubes flush, or upon a line on their exterior surfaces for artesian wells, or for other purposes, or any other mode substantially the same which will produce the same effect."

124. For an *Improved Mill Dress;* George L. Dulaney, Mount Jackson, Assignor to Reuben Allen, Shenandoah Co., Virginia.

Claim—"The construction of a compound elbow mill dress, formed by the divisional mode of calculation, having main elbow leads, gutters, or grooves, formed with secondary or branch elbow leads or conveys, communicating directly therewith instead of being a distinct or separated series; the said compound elbow dress being formed upon the face of a mill stone having an inward sloping or depressed surface, together with an outward sloping feed or supply circle."

125. For an *Improvement in the Manufacture of Artificial Stone;* Thomas Hodgson, Brooklyn, New York, Assignor to Robert L. Wright, City of New York; patented in England, May 9, 1854.

Claim.—"The composition formed by the admixture of sand or pulverized stone, plaster of paris, and beasts' blood, when these ingredients are mixed in the manner, and in about (without limiting myself precisely to) the proportions to be moulded or cast, while in a plastic state, into blocks, architectural ornaments or devices, statuary, or ornamental or other forms or figures, and in such conditions used as a substitute for stone, for building, architectural, or other ornamental purposes."

126. For an *Improvement in Machines for Boring Cylinders;* Marvin S. Otis, Assignor to Charles Rumley, Rochester, New York.

Claim.—"The arrangements of the parts so as to produce an alternating transverse motion of the cylinder, in combination with a rotating movement of the cutter, or vice versa."

127. For an *Improvement in Making Nuts;* Isaac H. Steer, Winchester, Va., Assignor to Henry Carter, Pittsburgh, Pa.; ante-dated December 19, 1854.

Claim.—"1st, Making a nut at a single operation from a heated bar or plate of metal by cutting off the blank from the bar, punching a hole or eye through it, and swaging it into shape. 2d, Punching the eye of the nut in a die or press box, by which it is surrounded and firmly supported, and thus prevented from straining or bursting during the operation. 3d, Shaping nuts by subjecting them while hot to powerful and sudden compression on the punch, and in the punching die, whereby they are finished with such a degree of smoothness, regularity and precision, that in the condition in which they come from the machine they are fit to use in the construction of most kinds of machinery, and are at the same time sounder and stronger than unpressed nuts made by machinery."

JUNE 26.

128. For an *Improvement in Bridle Winkers;* Wm. Boyd and Wm. F. Boyd, Watertown, Massachusetts.

Claim.—"Forming the flaring or projecting portions of the winkers of horse bridles on metallic plates."

129. For an *Improved Wrench;* Charles B. Bristol, Naugatuck, Conn.

"The nature of the invention consists in constructing the wrench with a revolving set of spaces to receive the nut, making as great a variety of sizes as the size and strength of the disk will admit of, or as may be desired, and so that the appropriate size may be used in any desired position."

Claim.—"The combination of the disk with the stock and binding pin."

130. For an *Improvement in Weather Strips for Doors;* Martin Croke, City of N. Y.

Claim.—"Placing or securing a strip or strips of india rubber within a bar, which bar is fitted within a recess in the lower end or edge of the door, the bar being rendered adjustable by the set screws."

131. For an *Improvement in Corn Shellers;* Abram Clow and Charles N. Clow, Port Byron, New York.

Claim.—"The tube in combination with the screw on the shaft, for discharging the cobs separately from the shelled corn."

132. For an *Improvement in Brick and Tile Machines;* Henry Clayton, Dorset Square, England; patented in England, December 13, 1852.

Claim.—"Combining with the wires their sliding scrapers or cleansing mechanism. Also, the combination of the accelerating roller and the tilting board with the delivery rollers, or their equivalent."

133. For an *Improved Mode of Hanging Window Sashes;* Daniel N. Dunzack, Salem, Massachusetts.

Claim.—"Attaching the cords to the lower ends of both sashes, and having said cords pass through pulleys, *b*, attached to the weights, the cord at each side of the frame or casing being attached to both sashes, said cords passing over pulleys, *d*, at the centre of the frame or casing."

134. For an *Improvement in Ice Pitchers;* Samuel Eakins, Philadelphia, Pa.

Claim.—"The arrangement of spout, lid, arm, and weight."

135. For a *Tidal Alarm Apparatus;* Moore Russell Fletcher, late of Concord, N. H.

Claim.—"The improvement by which the bell is sounded both at rise and fall of the tide, meaning the two tripping cams applied to each hammer, in combination with the float and weight as applied to the barrel, and made to put in revolution the said barrel, and thereby cause the tappet cylinder to actuate the hammers either during the rise or fall of the tide."

136. For *Carpenters' Mitre and Bevel Square;* Jonas S. Halsted and Cornelius J. Ackerman, City of New York.

Claim.—"Having a ledge or flanch project, one each side of the inner edge of the handle, the upper and lower ends of said handle being cut or beveled at an angle of 45°. The handle being provided with a blade, which is attached at right angles to it, and also provided with an adjustable blade."

137. For a *Balance Valve;* Charles S. Harris, Holyoke, Massachusetts.

Claim.—"The combination of two valve surfaces acting on the two feather edged valve seats, one inside and the other outside the casing or box, in such a manner, that the pressure in one direction on one, is compensated by an equal pressure in an opposite direction on the other, so that the valve will remain in a state of rest without being affected by any pressure, whether on the inside or outside of the casing or box."

138. For an *Improvement in Brick Machines;* A. V. Hough, Green Castle, Ind.

Claim.—"The slides placed at the bottom of a pug mill for the purpose of enabling the operator to regulate the rapidity of the egress of the clay, according as it requires to be subjected to the operation of the cylinder for a longer or shorter time. Also, placing the shaft with its blades in a horizontal position within the cylindrical case, whereby the machine is rendered extremely simple, the journals kept free from clay, and all the parts of the machine operated by the rotation of a single shaft."

139. For an *Improvement in Gas Burners;* Chas. H. Johnson, Boston, Mass.

Claim.—"Combining the gas distributer and purifier with the burner, so as to operate therewith."

140. For an *Improvement in Cotton Gins;* R. A. L. McCurdy, Sabine Parish, La.

Claim.—"The cylinder screen for the reception of the boll, hulls, &c., and the continued spiral flanched shaft arranged inside of said cylinder screen, for the purpose of working out said boll, hulls, &c., or substantially the same, and that will produce the intended effect."

141. For an *Improvement in Horse Collar Blocks;* Peter Moody, Indianapolis, Ind.

Claim.—"The combination and arrangement of the hinge, the slides, levers, and regulators, or severally the equivalents thereof, so as to secure the stretching, stuffing, and blocking of a horse collar of leather, cloth, india rubber, or other material, without removal from the block."

142. For an *Improvement in Churns;* Isaac M. Wade, Clinton, Mich.

Claim.—"The construction and arrangement of the wings or beaters attached to the lower end of the shaft, slats attached to the inner side of the case or tub, and the brakes attached to the dish."

143. For an *Improved Gas Lighter;* Wm. Wilder and Lucien Moss, Philadelphia, Pa.

"The nature of the invention consists in making a portable instrument, for at the same time turning on gas, lighting gas, and carrying matches."

Claim.—"The arrangement of sliding spring catch, taper, and wrench, with the holder."

144. For an *Improvement in Seeding Machines;* Moses D. Wells, Morgantown, Va,

Claim.—"The serrated agitator, adjustable vertically within the slot, for regulating the discharging capacity of the machine. Also, the supplemental slides, for enabling the agitator to preserve a constant reciprocation under all changes of discharge capacity."

145. For an *Improvement in Machines for Cleaning Ore;* Bearnard O. Bryan, Marietta, Pennsylvania.

Claim.—"The arrangement of the solid cast iron horizontal circular plate, having solid raised arms with upright ends, operating in a ribbed cylinder with the frame with centre piece for the purpose of scattering the ore on to the sieve underneath."

146. For an *Improvement in Straw Cutters;* Henry Peckham, Kings' Ferry, N. Y.

Claim.—"One or more knives hung on a pivot in combination with a revolving disk, or its equivalent, carrying one or more slots."

147. For an *Improved Fuse Stock for Comb Shells;* Abraham Powell, Jr., Mare Island, California.

Claim.—"A double cylinder fuse stock, so graduated as to burst shell shot at any required number of seconds."

148. For an *Improvement in Railroad Car Brakes;* Elisha E. Rice, Hallowell, Me.

Claim.—"1st, The construction of the brake with one flanched and one plain shoe. 2d, The combination of the guide bracket extending from the frame of the truck nearly down to the rail, the shoe with its sliding frame; the spring, to allow the shoe to yield, and the beam, for pressing down and raising up the shoe, so that the spring and shoe are supported near the rail, and the shoe rigidly held from any lateral movement whatever, while it is free to rise and fall. 3d, The weighted drop lever in combination with the shoes."

149. For an *Improved Adjuster of Window Blinds;* Alfred A. Starr, City of N. York.

Claim.—"The application of the spring friction bolt to one of the slats of the shutter or blind, in such a manner, that it shall turn with the slat and allow of the slat being adjusted to any angle, and, at the same time, bear with considerable force against the inside edge of the side strip of the frame of the shutter or blind."

150. For an *Improvement in Window Blinds, Doors, &c;* LaFayette Stevens and Solomon B. Ellithorp, Elmira, New York.

Claim.—"1st, The forked lever with the ferrule on the end, or the fork with a flat shaft at the end, made of either cast or wrought metal. 2d, The application of the rods, made either of metal, wood, leather, or their equivalents. 3d, The ground style with the fillet attached."

151. For a *Wheelwright's Guide Mandrel;* Joseph Sykes, Mercer, Pa.

Claim.—"The combination of the mandrel with its permanent and loose journals, and the circular plates or cones, either plates or cones being used as circumstances require."

152. For an *Improvement in Machines for Cutting Grain, Grass, &c.;* Charles Taylor, M'Keesport, Pennsylvania.

Claim.—"The use of a series of knives or cutters connected with the frame of the machine at the point or angle formed by the connexion of each pair of cutters, but not connected with the machine or with each other at the heel, and removable at pleasure."

153. For an *Improvement in Hand Machines for Pegging Boots and Shoes;* Reuben H. Thompson, Buffalo, New York.

"The nature of the invention is, 1st, A device for gauging the distance between the pegs, and causing the machine to move accurately the proper distance after the peg has been driven, for the insertion of the next peg. 2d, A device for feeding the peg wood to the knives which cut off the pegs."

Claim.—"1st, The spring spacer or stepping instrument. 2d, The spring feeder."

154. For *Improvements in Packing for Stuffing Boxes, &c.;* Joseph H. Tuck, Pall Mall, England.

Claim.—"The forming of packing for pistons or stuffing boxes of steam engines, and for like purposes, out of saturated canvas, so cut, as that the thread or warp shall run in a diagonal direction from the line or centre of the roll of packing, and rolled into form, either in connexion with the india rubber core, or other elastic material."

155. For an *Improved Steam Boiler Furnace;* Thomas Champion, Washington, D. C.

Claim.—"Using the exhaust steam in a closed stack, as a blower to return the heated gases or products of combustion with which it commingles back through flues or passages to the fire again and again, to be reburned."

156. For an *Improvement in Attaching the Raker's Seat to Harvesters;* Stephen Hull, Poughkeepsie, New York.

Claim.—"The placing or fastening of the raker's seat on the bar, by means of a bar of iron or steel, or any other equivalent device, near the inside of the main frame, in such a manner, that the weight of the raker, when on his seat, will rest on the bar."

157. For an *Improvement in the Cutters of Harvesters;* John H. Manny, Rockford, Ill.

Claim.—"Constructing the cutters of harvesters with clearing notches. Also, the combination of clearing hooks with the cutters of harvesters."

158. For an *Improvement in the Guard Fingers of Harvesters;* John H. Manny, Rockford, Illinois.

Claim.—"Forming the finger with an obliqe neck."

159. For an *Improvement in Corn Planters to be operated by Hand;* Oren Stoddard, Busti, New York.

Claim.—"The arrangement of the follower or plunger, dropping or sliding plates, and agitators or distributers, formed by the levers provided with cross-arms and rods."

160. For an *Improvement in Machines for Making Harness for Looms;* Jacob Senneff, Philadelphia, Pennsylvania.

Claim.—"1st, The method of winding the heddles on the shafts, by revolving the tube through which the yarn is supplied from the spool at its end alternately around the shafts and flanches surrounding the stationary cylinders as they pass through said cylinders, and guiding the same by the followers or guides at its ends, passing through the circular spaces or slots communicating with each other, and delivering the yarn to the shafts during the revolutions of the tube from the end of the grooved radial swinging arm turning loosely on its end. 2d, The combination of the adjustable spring and radial swinging arm with the tube for delivering and tempering the tension of the arm. 3d, The combination and arrangement of the bent rods on the rock shaft, alternately operated opon by the tension of the yarn as it is laid on the shafts, eccentric cam, slotted bar having a notch on its side and enlarged at its lower ends; hub, with inclined surface, corresponding with the inclined surface of the enlarged part of the slotted bar and the horizontal, longitudinal, and transverse sliding rods, the whole forming the essential part of the apparatus for stopping the machine upon the breakage of the yarn."

Re-Issues for June, 1855.

1. For an *Improvement in Looms;* Barton H. Jenks, Bridesburgh, Pa.; dated June 5, 1855; original patent dated April 3, 1855; re-issue dated January 8, 1855.

Claim.—"The yielding rest or support for the picker to break the sudden blow or concussion with which the shuttle impinges upon the picker, thereby preventing the filling of the cop from being jarred off and entangled, and relieving the picker from danger of being broken. Also, separating and freeing the lever and the picker from the end of the shuttle by the same movement which shifts the shuttle boxes, operating through a combination of levers, cams, and springs, or through levers, cams, or treddles worked from any part of the loom."

2. For an *Improved Nut and Washer Machine;* Henry Carter and James Rees, Pittsburgh, Pa.; dated June 19, 1855; original patent dated August 26, 1851.

Claim.—"Cutting the blank from a heated bar of iron, punching its eye in a closed die-box, pressing it into shape while in the die-box and on the punch, and then discharging it."

Design for June, 1855.

1. For *Stove Plates;* Saml. W. Gibbs, Albany, N. Y., Assignor to Skinner and Brothers, Brownville, N. Y.; dated June 26, 1855.

Claim.—"The combination and arrangement of ornamental figures and forms, forming the ornamental design for the plates of a cooking stove."

JULY 3.

1. For an *Improvement in Sand Paper Cutting Machines;* William Adamson, Philadelphia, Pennsylvania.

Claim.—"The employment of thin elastic blades of uniform thickness, so arranged, that the revolving blade shall overlap slightly the stationary blade."

2. For an *Improvement in Fire Arms;* Ethan Allen, Worcester, Massachusetts.

Claim.—"So combining a rotary or movable breech and a charge chamber together and with the barrel of a fire arm, that not only when they (the said breech and chamber) are moved or rotated in one direction, shall the breech uncover the passage into the barrel, and such charge chamber be brought into a position to permit a cartridge to be passed into it and the barrel, but when they (the said breech and chamber) are rotated in the opposite direction, such breech shall be made to cover the passage into the barrel, and such charge chamber, in conjunction with the barrel, be caused to bend, break, and hold such cartridge. Also, the charge chamber and breech block are provided with journals and bearings extending the movable breech beyond the block, in order that not only may said breech serve as a scraper to the inside surface of the case, but that the block may be protected from the injury and friction of the carbonaceous matter resulting from the explosion of a charge."

3. For an *Improved Machine for Sawing Shingles, etc.;* A. C. Billings and B. H. Ruggles, Palmer, Massachusetts.

Claim.—"1st, Giving the proper feed motion to the carriage by means of the inclined or wedge shaped projection on the gate, lever, and pawl, which acts against a rack on the underside of the carriage. 2d, Connecting or attaching the head block to the carriage, by means of the spiral spring, for the purpose of allowing the head block to yield or give when necessary."

4. For an *Improved Self-Regulating Wind-Mill;* Addison P. Brown, Brattleboro', Vt.

Claim.—"1st, The helical slot and pin as a means of governing the degree of obliquity of the fans to the wind. 2d, The combination of weights with the helical slots and pins."

5. For an *Improved Burglar's Alarm;* Ephram Brown, Lowell, Mass.

Claim.—"Arranging the locking and discharging levers, the main and secondary knob rods, the unbolting lever and bolt rod. Also, arranging the key levers with respect to the locking and discharging levers, and combining such key levers with the locking and discharging levers by one or two series of sliding pins, or their equivalents, made to operate through holes in a block arranged with respect to the locking and discharging levers. Also, arranging the alarm apparatus with respect to the locking and discharging levers. Also, arranging the counter wheel or apparatus, and combining it with the alarm apparatus. Also, combining with the lever the third knob, by which said lever may be operated under certain circumstances. Also, arranging the main and secondary knob rods so that the latter may slide through the former, or the former be made to slide on the latter."

6. For a *Machine for Boring and Turning Wood;* Adolph Brown and Felix Brown, City of New York.

Claim.—"1st, The manner of guiding and turning round the wood by passing said wood through suitable holes made through the wheels, thereby allowing the wood to be fed up to the tools at the same time the same is turned round. 2d, The ring with the tools for cutting off the wood."

7. For an *Improvement in Harvester Reels;* Gardner A. Bruce, Mechanicsburgh, Ill.

Claim.—"Constructing the bars of the reel, having the pivots at the ends of said bars placed at the edges of the ends and fitted loosely in holes at the ends of the radial arms, so that the bars may, by their own gravity, remain in a vertical position as the reel rotates."

8. For an *Improvement in Grain and Grass Harvesters;* Sylvester Colburn, Ansonia, Connecticut.

Claim.—"The employment of the elastic plates fitted within the fingers and acted upon by springs."

9. For an *Improved Mill Step;* Julius C. Dickey, Saratoga Springs, New York.

Claim.—"The application of the roller and lever for adjusting the height of the mill spindle, when the latter rests in the tube and said tube is secured to the tram block."

10. For an *Improvement in Attachments for Lightning Rods;* Robert D. Dwyer, Richmond, Virginia.

Claim.—"Constructing a lightning rod holder of but two parts, of such a form that the lightning rod will connect them to each other at the same time that it combines itself securely with them."

11. For an *Improvement in Locking Latches for Doors;* Edmund Field, Greenwich, Connecticut.

Claim.—"The arrangement of the locking bolt with the catch, when these parts are hung and operate together, and so that the locking bolt with its tumbler, guards, and other appurtenance or appurtenances, when not being used to lock the door, are set in motion by the catch each time it is operated."

12. For an *Improvement in Machines for Washing Sand;* George Finley, Collins Township, Pennsylvania.

Claim.—"The use of the jet block, or its equivalent, for the purpose of distributing the sand and water over the surface of the sieve."

13. For an *Improvement in Knitting Machines;* Thos. Fowler, Cohoes, N. Y.

Claim.—"1st, Combining a revolving radiating series of horizontal fixed hooked needles, and a series of vertical movable hooked needles, that are so operated within and by a revolving slotted cylinder, or its equivalent, and by cams, that the two series of needles shall operate together, and with one or more than one set of appliances, each consisting of one sinker and two pressers, and make cylindrical ribbed work. 2d, Combining and arranging the set of movable needles with the revolving slotted cylinder, and one or more than one set of stationary cams, each set consisting of the cam, and a depression and an elevation in the cam ring, so that the movable needles shall be successively carried outward to cast off the old stitches from the radial needles, and then downward to cast off the old stitches from themselves, and finally, upwards and inwards to allow the yarn to be again fed upon the radial needles in their revolving course."

Improvements Claim.—"1st, The inside guide stitch with the two sets of needles, to help cast off the old stitches of the radial needles, and to increase the distance between the old stitches and the new ones upon the movable needles at the same time their barbs are depressed. 2d, The outside stitch cam, to help cast off the old stitches of the movable needles. 3d, The cam to assist the return of the movable needles to, and to retain them in the position they occupy during the feeding of the yarn upon the radial needle."

14. For an *Improved Book Clasp;* Charles Folsom, Cambridge, Mass.

Claim.—"The book clasp constructed of strips of sheet metal bent at right angles, one being furnished with a slot, and the other with a tightening screw, by which the two may be secured together, to accommodate the clasp to books of different sizes."

15. For an *Improved Horse Power;* H. H. Fultz, Lexington, Mississippi.

Claim.—"The application of the driving wheel in combination with the shaft and pinion."

16. For an *Improvement in Steam Boilers;* James Harshiman, Dayton, Ohio.

Claim.—"Forming an external casing or covering of copper for stoves, and all heat-diffusing devices, or apparatuses, and steam boilers."

17. For a *Machine for Cutting Cavities, Spherical, Ellipsoidal, etc.;* Isaac B. Hartwell, Woodstock, Vermont.

Claim.—"1st, The spherical shell or cutter turning at the same time on the axis of the sphere of which the shell is a part, so as to cut a spherical groove or a convex and concave surface of less extent than a quadrant of the superficies of a sphere, yet corresponding in shape to the convex surface of a spherical section formed by two planes passing through the sphere at right angles. 2d, The method of giving a compound motion to the spherical shell or cutter, by means of the tight gear wheel and the loose gear wheel revolving on the axis of the rocking frame, so as to be in connexion with the pinion in all necessary positions of the rocking frame. 3d, The use of circular saws set in an oblique sliding frame, in connexion with the spherical cutter, for the purpose of cutting straight grooves to connect with the spherical grooves at each end of the block of wood."

18. For an *Improvement in Lard Lamps;* James D. Hays, Mt. Morris, Ill.

Claim.—"The combination of the cylindrical chamber, piston, and the valve at the lower end of the wick tube, whereby the lard is retained in the wick tube when the piston is removed back to re-fill the chamber."

19. For an *Improved Apparatus for Setting Bows to Carriage Tops;* Edward Hayes, Wheeling, Va., and Morgan Hayes, Washington, Pa.

Claim.—"Setting or adjusting the bows for carriage tops by means of a framing provided with clamps, adjustable pieces, and adjustable arms or pivots."

20. For a *Method for Regulating the Issue Apertures and of Suspending Turbine Wheels;* Birdsill Holley, Seneca Falls, New York.

Claim.—"The mode of opening and closing the issues and regulating their extent, in combination with the mode of hanging the revolving wheel."

21. For an *Improvement in Grain and Grass Harvesters;* William H. Hovey, Springfield, Massachusetts.

Claim.—"The employment of the "clearers" attached to the bar and working in the recesses of the fingers, for the purpose of preventing the choking or clogging of the sickle, the bar being connected to one or more of the cutters by pivots, by which, motion is communicated to them."

22. For a *Method of Hanging Plane Stocks to their Mouth Pieces;* M. G. Hubbard, City of New York.

Claim.—"The construction and attachment of the plane stock and pressure bar to the bed frame of the planing machine, by which the pressure of the bar is regulated, and the bar and plane stock can be turned back to sharpen the plane. Also, jointing the floating or front plane to springs or bars turning on a pivot to rise or fall over the inequality of the board."

23. For an *Improvement in Machines for Making Rivets;* Fredk. W. Hoffman and Ch. W. Gustav Fordan, County and State of New York.

Claim.—"The knife, so arranged in relation to the lower jaw or jaws and the header, that while it serves as a cutter, it also moves up the inclined plane jaw, and forms a solid support for the rear end of the blank during the making of the head."

24. For an *Improvement in Attaching the Connecting Bar to the Cutters of Harvesters;* James Little and Wylie Little, Princeton, Indiana.

Claim.—"Connecting the pitman or connecting rod to the sickle bar, by means of the cylindcrial projection on the end of said bar and the loop at the end of the connecting rods, whereby the pitman may be readily connected to and detached from the bar, and at the same time a durable connexion or attachment of the bar and pitman obtained."

25. For an *Improvement in Screw Fastenings;* **John London and Otto Ahlstrom, City of New York.**

Claim.—"1st, Constructing the head of a screw bolt of fixed wedges or inclined pieces and loose expanding pieces, whereby the act of screwing up the nut is caused to expand the said heads for the purpose of making it fit tightly in a suitable cavity or hold in which it is placed, or what is equivalent, constructing the nut with the said fixed wedges or inclined pieces and expanding side pieces, so that by screwing in the bolt, it may, in the same manner, be expanded to fit tightly within a suitable cavity. 2d, Forming the fixed wedges or inclined side pieces of the bolt or nut up the sides of the bolt, so as to get a great length of bearing for the expanding pieces with a small sized bolt head or nut. 3d, Confining the expanding pieces to the bolt or nut by means of an elastic ring, which keeps them always in condition to use on the bolt or nut, and which allows them to expand, and to remain parallel during their expansion, and contracts the collar when the nut or bolt is unscrewed, and allows the bolt or nut to be removed."

26. For an *Improvement in Sewing Machines;* Jean Pierre Molliere, Lyons, France; patented in France, May 30, 1854.

Claim.—"1st, The movable fulcrum of the graduated sliding piece, for lengthening or shortening the arm of the lever, in connexion with the catches, of different lengths, whereby the movement of the rack shaft or of the pinion, can be varied at pleasure, so as to produce any length of stitch that may be desired. 2d, The guides of the tooth rack and the rollers for keeping in place the adjustable piece carriers and the tooth rack, which steadily pushes forward the piece to be sowed, so as to secure a regular succession of stitches. 3d, The action of the hook or lever *h*, when the upper needle carrier is ascending upon the lever *i*, whereby the point bearing upon the rods make it press the piece, *m*, against the piece *n*, so as to seize and hold fast the needles between the shoulders of the pieces *m* and *n*, at the moment when the lower carrier has driven them through the piece to be secured. 4th, The lever and its two hooks, for passing beyond the line of sewing, and taking hold of the thread at the moment when the needles are held above the plates, and pulling it after them, and closing up the same, together with the apparatus for overcoming the obstacle arising from short threads. 5th, The stopping levers for arresting the two needle carriers in their course when the thread breaks, which, by throwing the ball out of perpendicular, ungear the catches by the piece, K H, and so bring the machine to a stop. 6th, The sewing of every kind of seam, whether straight or crooked, by what is known as the shoemaker's stitch."

27. For an *Improvement in Trip Hammers;* Milo Peck, New Haven, Conn.

Claim.—"So controlling the admission and exit of air above the piston, that the force of the blow given by the hammer may be regulated by the condensation and attenuation of the air."

28. For a *Machine for Dressing Conical Tapering Surfaces;* Paul Peckham, Petersham, Massachusetts.

"The nature of the invention is to dress or round a tapering stick of wood, so that, while it has one flat surface, the rest of it in transverse section, may be in the form of a segment of a circle."

Claim.—"The arrangement and application of the depressing rest with respect to the hollow tubular cutter stock, so as to enable a person to dress or round a tapering stick of wood."

29. For an *Improvement in Mowing Machines;* Samuel Rockafellow, Coatsville, Pa.

Claim.—"Raising and depressing the finger bar, K, and consequently the cutters, by means of the vertical bars, M M, having wheels at their lower ends, arm P, attached to the cross piece of the bars M M, lever, and shaft, with its arm S, attached."

30. For an *Improvement in Machines for Shucking and Shelling Corn;* John J. Rollow, Fredericksburgh, Virginia.

"The nature of the invention consists in the construction and arrangement of the concave operating in combination with the toothed revolving cylinder in such a manner, that when the corn in the shuck or husk is fed into the machine through the hopper, the husk is first parted down two opposite sides, the same as it is commonly done by hand, and is turned backward one-half each way over the stalk of the cob, leaving the corn on the cob to be rubbed or rolled off."

Claim.—"The diagonal ribbed perforated concave, when hinged at the upper end, and supported on springs at the lower end, in combination with the diagonal ribbed cylinder."

31. For a *Machine for Feeding Sheets of Paper to Printing Presses;* A. H. Rowand, Alleghany City, Pennsylvania.

Claim.—"The employment of the swinging frame provided with the rollers, in combination with the vibrating arm and clamp or lip operated by the slotted bar."

32. For a *Method of Cutting Straight or Curved Mortises;* Edward Q. Smith, Cincinnati, Ohio.

Claim.—"The two segment pieces placed at an angle to each other or straight, so as to direct the lateral movement of the mortising chisel in a curved or right line, and thereby form a curved or straight mortise."

33. For an *Improvement in Corn Planters;* William Stinson, Georgetown, Pa.

Claim.—"The arrangement of the seed rollers and corn box in the spoke of the wheel in combination with the spade."

34. For an *Improvement in Looms;* Samuel T. Thomas, Lawrence, Mass.

Claim.—"Working the picker staff in opposite directions by means of a flexible strap having sufficient stiffness to move said picker staff backward when said strap is moved by a lever. Also, combining with the operating lever and the forked lever of the stop motion, a lever or pitman, and a tripping or rocking lever, or the equivalent thereof, the same being for the purpose of operating the lever of the shipper, and relieving the forked lever of strain; the said improvement enabling to be used a forked lever of great lightness and delicacy of construction, and capable of being operated by the finest qualities of weft and thread. Also, arranging and combining the friction pulley, the band, the levers and spring, or its equivalent, so as to operate together, and with respect to the yarn beam."

35 For an *Improvement in Looms;* Samuel T. Thomas, Lawrence, Mass.

Claim.—"Combining with each rocker lever and the lifter thereof, an arm, cam, and sector, or the equivalent or equivalents thereof, the whole being applied together. Also, combining with the series of lifters and the pattern prism, a series of bent levers, or their equivalents, and imparting to the pattern prism vertical or up and down movements. Also, when the upper and lower sets of cords of a harness are supported by pulleys, applying both said upper and lower sets of cords to one and the same end of a lever operated by a cam having a continuous rotation. Also, combining with the star cam and lever for moving a set of shuttle boxes, a mechanism for imparting an accelerated movement to the set of shuttle boxes, the said mechanism consisting of an additional lever, a movable wedge and its operative mechanism. Also, the arrangement of a jacquard, the wires thereof, the impelling pawls, and the star cams and their shaft, where one jacquard apparatus applied at one end of the loom is made to operate two independent shuttle motions of the loom. Also, so applying to the main shaft a friction clutch wheel and a fly or balance wheel, that the fly may run loosely upon the shaft, and be capable of being moved either towards or away from the friction clutch, in combination with so connecting the fly with the shipper, that the said fly shall be moved laterally during and by the movements of the shipper. Also, combining with the friction wheel and the shipper, a brake mechanism, for throwing said brake into and out of operation, such mechanism consisting of the lever latch, the projection, and spring."

36. For an *Improvement in Spring Bed Bottoms;* Hiram Tucker, Cambridgeport, Massachusetts.

Claim.—"Arranging and connecting the flexible bar, and lifter, and counter sway springs, (or their equivalent,) together and within the frame, so that each, when a mattress is laid upon it, shall extend under and give support to such mattress and operate as an elastic foundation therefor."

37. For an *Improvement in Horse Collar Blocks;* T. J. Van Benschoten, Poughkeepsie, New York.

Claim.—"The arrangement and operation together of the obliquely sliding back jaws along either side or edge of the collar on its interior with the stationary front jaw to the narrow or upper end of the collar. Also, giving to the obliquely sliding jaws, acting separately but in concert, increased freedom of action or play on their ways, to effect simultaneously the lateral and longitudinal stretch of the collar by connecting the freely supported operating screw nut with the obliquely sliding jaws by spring arms."

38. For an *Improvement in Paddle Wheels;* John Upham Wallis, Danville, N. York.

Claim.—" Attaching the innermost or central portion of the buckets rigidly to a single wheel or central rim, and staying the outer portions thereof, to the said rim by stays, whereby the construction of the wheel is simplified and great strength is obtained."

39. For an *Improvement in Ploughs;* Nicholas Whitehall, Attica, Indiana.

Claim.—" The arrangement and connexion of the handles, arms, plough beams, and seat."

40. For an *Improvement in Cooling and Drying Flour;* George Butler Willison, Elizabeth, Pennsylvania.

Claim.—" The application of a draft of cold air over and around the upper mill stone, in grist mills, between the stone and the curb, to prevent sweating on the stones and curb, and to cool and dry the flour by means of the fan, in combination with the annular and tangential flanches inside the curb, to serve as a guide for the current of air and the ventilating tube or tubes."

41. For an *Improvement in Apparatus for Heating Feed Water to Steam Boilers;* Robert Wilson, Columbus City, Iowa.

Claim.—" The arrangement of the feed water pipe, opening within the exit steam pipe, in relation to the exhaust steam pipe within the feed water reservoir, whereby the entire exhaust steam may be condensed, and the entire feed water pass through."

42. For an *Improvement in Stoves;* Robert Wilson, Columbus City, Iowa.

Claim.—" The combined cylinder stove and oven, lined with removable rolls of sheet iron."

43. For *Improvements in Sewing Machines;* Jerome B. Woodruff, Washington, D. C.

Claim.—" The making of the needle bar hollow and providing it with a door or slide, for the purpose of holding incased therein such parts of the machine as may be desired, whether the needle bar be ornamental or otherwise. Also, the direct and positive connexion of the needle arm and shuttle carrier, by which means they both move simultaneously and in perfect harmony with each other, so that whichever way the pulley is driven, the operation of the machine will be the same."

44. For a *Machine for Beveling and Polishing the Inner Edges of Daguerreotype Face Plates or "Mats;"* Edward Brown, Assignor to the Scoville Manufacturing Company, Waterbury, Connecticut.

Claim.—" The combination of the rotary burnisher, and vibrating or yielding frame."

45. For a *Machine for Mitering Printers' Rules;* Wm. McDonald, Assignor to R. Hoe & Co., City of New York.

Claim—" Attaching to the bed A, and framing a sector guide plate B, to which plate B, the bed F is secured by a set screw, the bed F having a curved projection attached to it, which projection works in a recess or groove in the plate B, by which the bed F, may be adjusted at the desired angle with the plate A, and the ends of the rules beveled or cut."

46. For a *Water Metre;* James Curtis and Samuel Hourd, Chicago, Illinois.

Claim.—" 1st, The employment of two chambers, having such communication with each other that the incoming water entering each cylinder or chamber, in its turn, will expel a volume of air previously containe[illegible]herein, and drive it into the other cylinder or chamber, and cause the said air to act as [illegible] piston to separate from the incoming water and to discharge, through the agency of the pressure thereof, the water in the other cylinder or chamber. 2d, Fitting a float valve to each end of the pipe through which the air is transferred from one to the other of the two measuring cylinders or chambers, so that in whichever cylinder the water should rise above its proper level by reason of the derangement of the inlet and outlet valves, the pipe will be closed and the flow of water stopped."

47. For an *Improvement in Cotton Presses;* Augustus M. Glover, Waterborough, South Carolina.

Claim.—" The use of the roller moving with the platen, in combination with the rack and pinion, for the purpose of preventing the platen touching the sacking in its descent, and keeping the platen in position when below the hopper, and the sides of the bale box removed."

48. For a *Cork Machine;* John Power, Boston, Massachusetts.

Claim.—"1st, Supporting the bed of the knife carriage near its centre, upon a bearing screw, and applying adjusting screws near its ends, for the purpose of making it adjustable at different heights, and either level, or at different inclinations. 2d, Giving rotary motion to the mandrel, or its equivalent, which revolves the cork by means of a band connected with the knife carriage and carrying a weight, the weight serving to keep tight the band and transmit motion from the knife carriage to the cork during the cutting operation, and also to draw back the carriage after the cutting operation."

49. For an *Improvement in Sewing Machines;* George W. Stedman, Vienna, N. J.

Claim.—"Mounting a bobbin, or its equivalent, and combining it with a reciprocating plate or looper, which is provided with a pointed projection extending before said bobbin, and arranged so as to enter the loop of the needle thread, then carry the bobbin over the outside of, and finally back through said loop, whereby the liability to miss the stitch and break the needle, together with the noise and friction of a shuttle, is avoided, the use of oil for lubricating the shuttle race dispensed with, and the consequent soiling of the thread prevented. Also, constructing the bobbin with one face sunk below or flush with the edge of the other face, its thread consequently unwinding from its face, instead of its periphery, for the purpose of preventing the loop of the needle thread getting inside of the bobbin."

50. For an *Improvement in Marine Engine Governors;* Thomas Silver, Philadelphia, Pennsylvania.

Claim.—"The employment of two oscillating balanced bars in combination with the spindle and spring, or any equivalent therefor, in such combination."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Some Experiments upon Coffee as a Beverage. By AUGUSTUS T. DALSON and CHARLES M. WETHERILL, Ph. D., M. D.

(Continued from page 65.)

The next experiment was performed upon a large scale, to ascertain whether the aroma lost in roasting coffee might not be collected advantageously. Fourteen pounds of coffee were roasted in two operations by *gas heat* in the following apparatus, which (without the condensing part) will be found admirable for use by those having coal gas at command, as the operation is a cleanly one and the temperature entirely under control. A cylindrical sheet iron vessel made air-tight for the experiment, was supplied at each end with an axis, to one extremity of which was adapted a handle for the purpose of turning, the other end was made of an iron tube 1½ inches in diameter and a foot long; the inside of the drum where this tube communicated, was fitted with an iron cap of 3 inches in diameter, standing out from the end of the drum, and pierced with holes to prevent the coffee from falling into the tube while suffering the vapors to escape. Two places of the axis near each end of the drum were turned smooth on the lathe, to allow the drum to rotate easily. About three inches of the end of the tube externally, were also turned smooth, so that it might be adapted to the neck of a large receiver by means of a cork in which it turned with an air-tight joint. From this receiver (which was cooled by water for the last half of the 14 lbs.) a rising tube permitted the vapor to pass into a Liebig's condenser and thence into two receivers cooled with salt and ice, and to escape through an organic analysis potash apparatus cooled in the same manner. This drum rotated in a rectangular stove made of sheet iron, with a hood of the same material, which was heated with a gas burner made in the shape of a gridiron of six tubes, communicating with each other and running longitudinally at the bottom of the oven and pierced with holes for the flames at an inch apart.

The first charge of seven pounds was roasted in an hour and thirty-five minutes. The coffee appeared well and gave an excellent infusion; it weighed 6 lbs. 2½ oz., corresponding to a loss of about 12 per cent., which agrees with Cadet's experiments, which gave 12½ per cent. loss for coffee roasted to reddish brown color. The result of the roasting of the second charge of seven pounds was not weighed, it gave a coffee in every respect like the first. The following are the results of the distillation, the same liquids of the two experiments being united. The receivers immediately attached to the drum contained about two fluid ounces of dark colored liquid, acid and odor empyreumatic but not very unpleasant. The taste was not at all like that of coffee; a small quantity of solid fat floated as a pellicle on the surface of the liquid. The receiver nearest the Liebig's condenser, contained a quarter of an ounce of light brownish yellow liquid of odor and reaction somewhat similar to the last; on standing, a few flakes deposited which dissolved in alcohol with a brown color. The next receiver contained a few drops of nearly colorless liquid which remained frozen while in the freezing mixture, and when melted possessed an odor somewhat like the others, but even more remote from a coffee smell. The Liebig's bulbs contained nothing, but smelled of the aforesaid hydro-carbons, which are probably the same as those described in Payen's experiments. In no instance could a liquid be obtained of sufficient quantity or reaction to warrant the advantage in a practical light, of collecting the aroma which might be therein. It appears in reality that but a small quantity of the aroma is lost in the roasting, and what is lost is mingled with very disagreeably smelling vapors, from which it would be very difficult to free it.

It became next interesting to ascertain whether a portable coffee could not be obtained by making an aqueous extract of raw coffee, evaporating to dryness and roasting the residue. Fifty-three grammes of raw coffee were pulverized and extracted with 200 grms. of cold water, and 25 per cent. of extract was thus obtained. The same quantity of raw coffee which had stood in the thermostat at 105° for 24 hours was powdered and gave 27 per cent. of extract. Another portion of 307 grms. was extracted in a displacement apparatus. These several extracts were roasted in the Florence flask rotated by the jack. The following is the result of some six experiments in which the temperature was varied in different ways. The dried extract began to stick to the sides of the flask when warm, and at 185° it smelled very much and formed bubbles like tannic acid when dried. If kept at 200° for a short time and even when heated as high as 230°, white fumes began to appear. The porous residue in the flask when dissolved in a little warm water, gives a delicious cup of coffee somewhat resembling that made in the usual manner but less acid and more bland to the taste. At 240° the coffee began to get bad, and the same effect took place if the temperature was lower but more prolonged. The great drawback to this mode of making coffee arises from a dark slimy residue which does not dissolve in water, and which, although tasteless, has a disgusting appearance. It is more trouble to filter the liquid from this substance than to make the coffee in the usual manner, and besides, it filters very slowly, stopping up the pores of the filter whether it be of linen or of paper. A great many different methods where tried to develop the good properties of the extract without forming this substance, but in vain. When the dried residue of the raw coffee berries from which the substances soluble in water had been removed was roasted, and an infusion made in the ordinary manner, it gave the most disgustingly tasting liquid that can be imagined. An experiment was now made to ascertain whether a very concentrated aqueous solution of coffee could not be made by cold displacement, thus extracting more soluble matter than is done in the household, and at the same time obtaining a portable coffee.* A pound of ground roasted coffee was placed in each one of a series of five displacement apparatus, and river water poured through them, a pint at a time, using that which had run through the first to pour upon the second, and so on through the series. The coffee swelled and each pound absorbed a quart of water during the swelling which it did not suffer to drop, but which was displaced by fresh water. By this means the first liquid which reached the end of the series, was very concentrated and its strength diminished with the liquid following. As soon as a quart and a half had been passed through one of the series, the absorbed liquid remaining in the coffee was pressed out by a hydraulic press of nine tons power, and the droppings added to the following numbers of the series, which were in turn treated in the same manner. The operation lasted 36 hours and the extract was collected in nine portions in the order of the following table, which represents, 1st, the quantity in fluid ounces of each portion; 2d, its contents in grms. of solid matter in an ounce evaporated and kept for 12 hours in the thermostat at a temperature of 100° C., and, 3d, the whole amount of dry residue in each of the nine portions as calculated from the experiments in No. 2, column 4, represents the amount of solid matter in one cup of 4·5 fluid ounces of each of the portions.

Successive Portions.	No. 1. Fluid ounces.	No. 2. Grammes of solid matter in one fluid ounce.	No. 3. Grammes of solid matter in the whole of each portion.	No. 4. Grammes of solid matter in one cup.
1	64·	3·382	216·448	15·129
2	37·	1·984	73·408	8·928
3	36·5	1·262	46·063	5·679
4	36·	0·778	28·008	3·301
5	35·	0·372	13·02	1·674
6	36·5	0·21	7·665	0·945
7	16·	0·127	2·032	0·571
8	12·	0.101	1·212	0·454
9	14·	0·079	1·106	0·355

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* C. M. W. is accountable for this experiment.

There were in all, 24 pints of water added, and the resulting portions of coffee solution amounted altogether to about 18 pints, from which it follows that notwithstanding the powerful pressure, the coffee residue retained six pints of water, or 1¼ its weight. When this coffee residue was dried it was much lighter in color than ordinary coffee, and a cup of infusion made with it in the ordinary way, had not the slightest flavor of coffee, and resembled in taste the decoction that one is served with in country taverns in the interior of this state.

Lehman obtained by the extraction of roasted Java coffee with boiling water, 21½ per cent. of dry residue, and Payen obtained 37 per cent. Calculations from the above table give a per centage of 17·18 extract from roasted Mocha coffee.

No. 4, represents the amount of solid matter in a cup of 4½ fluid ounces for the different portions. An experiment with the biggin, showed that when six fluid ounces of boiling water are poured upon about half an ounce of roasted Mocha coffee, a little over four and a half fluid ounces of coffee may be poured from the biggin; this is an ordinary cup full, and one fluid ounce evaporated and dried at 100° C., gives 0·131 grms. of residue, whence the cup full contains 0·589, equal to only 4·16 per cent. extracted from the coffee.* If on the other hand, coffee be made by boiling, using the above proportions (but not clarifying with white of egg in order to obtain results for comparison) a little less than 5 ounces of decoction are obtained, one fluid ounce of which contains 0·334 grms. of dried residue, or a cup of 4½ ounces contains 1·503 of residue; this corresponds to a per centage of 10·62 extracted from the coffee. It will be seen from this that, in the preparation of the coffee by boiling, about two and a half times as much matter is extracted from the berry as by the biggin, but even thus, less extract is obtained than by a prolonged displacement, which gave 17·18 per cent. The flavor of both biggin coffee, and that made by boiling is very good, the latter is somewhat more astringent, which taste is preferred by some, while the former has a more ethereal and delicate flavor.

Now to turn to the experiment tabulated on a former page, it will be seen that a cup of biggin coffee is equal in strength to portion 7, (column No. 4,) while the boiled coffee is equal to portion 5. The flavor of the different portions of the table was now tried by making a cup of coffee with them for the evening meal, by warming (diluting with water in some instances) and adding sugar and boiled cream. The weakest portion, 9, was first taken; the flavor was extremely bad, it was very weak, unlike coffee, and left a burning sensation in the throat which lasted during the whole evening. The flavor resembled that of the infusion made from the dried coffee grain residue of the displacement series. In proceeding to portion 1, this flavor gradually gave way to, or was marked by, the true coffee flavor. Portion 1, in the proportion of one volume to nine or ten of water gave a very good coffee, although inferior to that made by the biggin or long boiling. This dilution corresponds to a proportion of dried extract contained in coffee made by boiling, *i. e.*, 1·5 dried extract in a cup, so that by rejecting all but portion 1, the rest having more or less of an unpleasant flavor, there is no gain by preparing coffee in this manner, and even portion 1, would have been better, had the extraction been carried less far. The only advantage, therefore, would be in the portableness of the article, which, in some cases, would compensate for the extra expense. A pint of portion 1, was placed aside, with a pound of sugar, in a bottle not particularly well corked; the same quantity was placed in another bottle with half a pound of sugar. The last showed a slight tendency to mouldiness; that with a larger proportion of sugar kept very well. The effect of a teaspoonfull of this liquid, without warming or dilution, is peculiarly exhilarating and refreshing. A solution of this strength would, no doubt, be a valuable addition to the pharmacopœia, as it might be given in whatever dilution was desired, or undiluted when necessary, or where a speedy action was required, and would enjoy the great advantage of affording a medicine of known strength. The proportion for forming the infusion given in the United States Dispensatory, is an ounce of coffee to a pint of boiling water, but if the infusion be made by the servants of the house, its strength must be very uncertain, owing to their uncertainty in roasting the berry. In traveling and exploring expeditions such a solution would also be useful.

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* Payen obtained in a similar experiment, filtering ten times its weight of boiling water upon coffee; for brown coffee 16·5; for chestnut brown 19; and for red 25 per cent. of dry extract. See Erdman and Marchands' Journal, XXXVIII, 466.

With regard to the amount of substance (tannin, &c.,) precipitated by acetate of lead from portion 1, eleven fluid ounces yielded 23·05 grms. of lead salt, dried at 100°, and 0·857 of this salt contained 0·4625, or 53·97 per cent. of oxide of lead, corresponding to a mixture of lead salts of caffeotannic acid. It appears hence, that eleven fluid ounces of the coffee solution contains 10·61 grms. of substance precipitated by acetate of lead, or one ounce contains 0·965 grms. But from the table, a fluid ounce of this extract (portion 1,) contains 3·382 grms. of solid matter, consequently about one-fourth of the extract is caffeotannic acid more or less altered by the roasting. The filtrate from the precipitate by acetate of lead evaporated to dryness, heated, gave an abundant sublimate of caffeine in polarizable needles.

The preceding experiments have added but little to what is already known of coffee in its aspect as a beverage. The following rules may be acceptable to those desirous of insisting upon having their coffee made properly. The roasting should take place in a cylinder constantly turned, over a bright fire; when a white smoke begins to issue from the joints of the cylinder its contents must be carefully watched, and every few minutes a few grains extracted and their color and brittleness examined. As soon as they break easily into several fragments by a slight blow, at which time the color will be of a light chestnut brown, the operation is completed and the coffee, if it is in considerable quantity, must be cooled, by taking portions up in a large tin cup, and letting them drop through the air. The quantity of aroma which might be supposed would be lost in this way is inconsiderable, and the danger of over-roasting, if the coffee be left in a heap or covered up, is great. The coffee, both roasted and ground, may be kept in quantity without loss of flavor if the vessel be corked air tight. In preparing the infusion whether by the biggin or by boiling, both the coffee and the water should be *measured*, in the proportion of half an ounce (in weight) of coffee to a cup full of six fluid ounces of water for each cup of the infusion. A small measure containing somewhat less than an ounce of water will hold half an ounce in weight of ground coffee.

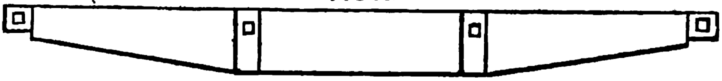
Those articles offered in the market under the name of "*extract of coffee,*" and which profess to enable one by adding them to ground coffee to save in the preparation of the beverage, are all worthless and catchpennies. They contain burned sugar, chickory, carrots, sometimes coffee, and other materials, and act only by giving a dark color to the infusion, and a peculiar taste, which misleads persons to think that the coffee made by their aid is stronger. The excellence of coffee as a beverage, depends upon its caffeine and a peculiar volatile oil, which are not contained in the above-mentioned additions. As early as the year 1782, one of these coffee essences was analyzed and found to contain alkaline carbonate, and it has been lately proposed by Pleischl to add carbonate of soda to the ground roasted berry in the proportion of 43 grains of the former to a pound of the latter, but it may be questioned whether this is a valuable addition, since Bœhmes observed that a small quantity was useless, while a larger quantity communicated an unpleasant taste to the coffee.

For the Journal of the Franklin Institute.

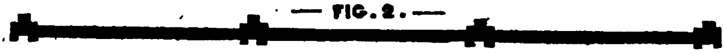
Description of J. C. Schlough's Patent Self-Retaining Grate Bars. By H. Howson, C. E., Philadelphia.

The rapid destruction of furnace grate bars, through excessive heat which causes them to warp and become otherwise deteriorated, has been since the general introduction of the steam engine, a source of great annoyance and expense to engineers.

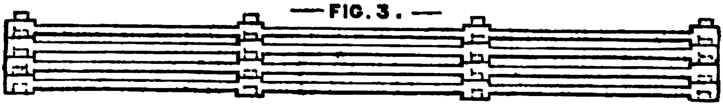
— FIG. 1. —



— FIG. 2. —



— FIG. 3. —

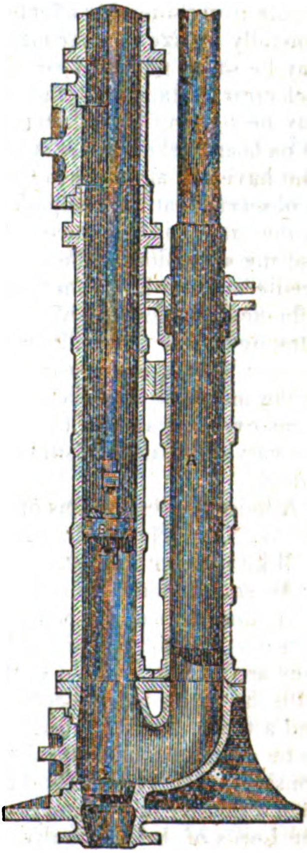


Various devices for preventing this evil have at different times been tried, with but little success, however, as the present general use of the common bar amply demonstrates.

The invention of Mr. Schlough, for which a patent was granted in May last, has the merit not only of simplicity, but judging from the numerous testimonials he produces, of efficiency also. Figs. 1, 2, 3, in the annexed engraving, represent a side view, sectional plan, and ground plan, of the self-retaining bars. The exterior form differs in no respect from that of common bars; on one side of each, however, are mortises, and on the opposite side tenons at the part where the bars touch each other, so that when a set of these bars are placed side by side, with the tenons of one fitting into the mortises of the next, it will be impossible for one bar to rise above another, thus maintaining an uniform level at the top, and preventing them from warping. The mortises and tenons are so arranged and constructed, that the bars may have a slight longitudinal, but no vertical movement independent of each other. In placing the bars in their proper position, to form a grate, it should be observed, that the whole number, with the exception of one, may be slided together sideways, the last bar being put in from the top, and acting as a key, must necessarily be without tenons at the side.

*Combined Forcing and Lifting Pump.**

The annexed sketch represents a combined forcing and lifting pump for draining mines. I have not seen a similar arrangement before, and as it may be useful in many situations, perhaps you will give it a place in your *Journal.*



It requires little explanation. The plunger, A, and the bucket, B, are both connected to the same end of the engine beam, and they rise and fall together. The bucket rods are in the inside of the rising column of pipes; the clack, C, is common to both. When the plunger, A, with its bucket, B, ascends, the water flowing through the clack, C, follows A and B. In descending, the clack, C, shuts, and the water displaced by the plunger flows through the bucket lids, which are open. In the next ascent, the bucket discharges its quantity of water so that the flow of water is continuous, and we have thus a forcing pump and a lifting pump working from the same power, with only one clack between them.

Many modifications of the same principle will suggest themselves. For example, the bucket rod may work through a stuffing-box, and be attached to the same dry rods to which the plunger is attached; and this is particularly applicable to lying pumps, where the rods are always carried outside of the pipes, and work the bucket through a stuffing-box.

An objection to the plan is the extra friction of the water passing through the bucket lids, when both the bucket and plunger are of the same diameter. This may apply when the velocity

* From the Lond. Practical Mechanics' Journal, April, 1855.

of the current exceeds 80 feet per minute, but at a less velocity the friction is not much felt, and there are few of the pumps worked with bell cranks at this speed. **Ralph Moore.**

Glasgow, March, 1855.

Correction of the Compass in Iron Ships.[*]

(Continued from page 58.)

The importance of the Astronomer Royal's remarks on the 'Correction of the Compass in Iron Ships,' published in the *Athenæum* of October 28, can hardly be overrated. Inapplicable as such structures may be for actual hostile encounter, their value as transports, as swift despatch boats, and as merchant vessels, is undisputed:—yet that value must depend, in some measure, on the compasses by which they are steered.

All seamen and the majority of the public are aware, that the magnetic needle is considerably affected by the iron of a ship,—but they do not so generally realize in their minds the fact, that a common steering compass may be some points in error, owing to the vicinity of iron, and that, if such error be unheeded, the ship, with perhaps a thousand souls on board, may be steering a fatal course, (as in the case of the *Birkenhead*,) while all on board believe there is no cause for unusual watchfulness. To those who have not attended to the subject of magnetism it may be pardonable to observe, that the compass-needle is not only drawn towards the poles by the magnetic influence which affects it under any circumstances, but that the attraction of the iron in the ship is an active agent, drawing the needle more or less from the position it would have, if free from any local influence besides that of ordinary terrestrial magnetism. This special attraction, now generally called deviation, is usually the greatest when the ship's head is eastward or towards the west, and least when nearly in the magnetic meridian. Moreover, it varies as the ship heels, or careens over, because of the varying position and influence of the iron and the varying relative position of the compass-needle, which remains horizontal.

Admirable illustrations of these effects have been given frequently by Sir W. Snow Harris, Capt. W. Walker, and Dr. Scoresby, besides other well known authorities.

As some, many, indeed, of the iron ships have inconveniently large deviation errors of the compass, it is indispensable to guard against them in some special manner. Her Majesty's ships are "swung"—that is, they are turned round—so that the bearing of an object may be taken with the ship's head successively on the principal points of the compass, and a table of errors formed, by which the courses afterwards steered are to be corrected, until the ship is swung again, or has changed her locality considerably. This method has been followed for many years—for more than a quarter of a century—sanctioned by those who were supposed by the Lords of the Admiralty, to be the best judges of the subject, especially Col. Sabine. So decided has been this view of the question, that the Board of Trade is now issuing recommendations to merchant ships to avoid the other plan,—which shall now be described. This other method is a mechanical correction of the errors, caused by the magnetic influence of iron in the ship herself, by means of magnets fixed near the compass. The high authority of the Astronomer Royal is given in favor of this manner of correction by magnets,—and is as decidedly expressed against the custom of her Majesty's Ships. There is no mistake on this subject. Both views are before the public in print. Both cannot be right. Which are practical seamen to adopt? The sooner the question is settled the better for all whose business is on the great waters, and for the improvement of navigation.

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[*] From the Lond. Athenæum, Nov. 11, 1854.

Respecting the process of "swinging" a ship, it may be observed that so much time and minuteness of detail as are now usually given are not necessary. Observations on a few well-chosen points of the compass are sufficient. From them a table or a diagram may be constructed. But the best time for swinging and turning a ship is when she is out of harbor with everything on board. A distant object may then be used as a mark, or transit bearings of known positions observed, While at sea the heavenly bodies, when not obscured, afford means of checking the compasses continually, especially (in this hemisphere) the polar star.

When a distant terrestrial object is visible, the deviation of the compass on any or every point may be quickly obtained by the difference between bearings with the ship in the direction which causes no deviation, and a bearing or bearings with the vessel placed otherwise. This is a simple method, though efficient. Alteration in the ship's local attraction or magnetism may take place from time to time; but, unless iron be moved near the compass, the position in which the ship herself acts on the needle, in the same direction as the general influence of terrestrial magnetism, remains nearly unchanged. A sailing vessel may often try one or two bearings in this manner without much inconvenience. A steamer may do so easily, as well as frequently.

It should never be thought safe to trust implicitly, or for a length of time, to any condition of magnetism. So subtle and variable an influence —subject to sudden or gradual change—whether from jarring blows, from vibration or from electrical action—ought always to be suspected, and therefore watched vigilantly. The Astronomer Royal expresses his opinion, that the sea does not cause such sudden blows as Dr. Scoresby refers to; but he will not be supported by nautical men in such a view. They who have felt the sudden shocks of heavy waves cannot be mistaken on that point.

Correcting Magnets—such as are recommended by Prof. Airy—are found to be very useful in ships employed within moderate limits of latitude, as in the North Atlantic and the Mediterranean; but they are always liable to uncertain change. A flash of lightning may destroy or reverse their polarity; yet the injury may be undiscovered till too late. In using magnets as correctors, it should be borne in mind that, if the ship's deviation is great, very powerful magnets must be employed to counteract it, or those used, if of inferior power, must be placed very near the compass; and then, when the ship heels much, for some time consecutively, the effect on the needle may be very much altered by being brought nearer to the magnet. The Astronomer Royal says, that "a quarter of an inch in the height of the compass may very greatly disturb the neutralizing influence of the magnets." When thus affected, the compass may indicate a bearing or course considerably different from that which it would show were the ship upright. Prof. Airy approves highly of Dr. Scoresby's experiments; yet their tendency, as stated to a large audience at Liverpool, was certainly to discredit the employment of the Correcting Magnets. In a surveying vessel, employed a quarter of a century ago, a neutral point was the station of the Principal or Standard Compass, at which point there was little or no effect of deviation visible, because there were balanced local attractions abaft, before, and on each side of the compass. The advantages of such a neutral point were suggested by the plan of Prof. Barlow, namely, the correcting plate, used by the lamented Captains Foster and Basil Hall. In all parts of a prolonged voyage round the world, the neutrality of that selected point remained unaltered, and its utility was undisputed.

In these remarks I have endeavored to avoid such technical terms as are not familiar to general readers, and all discussion of abstruse questions relative to induced or other kinds of magnetism. My sole object is to assist in drawing competent attention to a very important subject, immediately affecting life and property at sea.

I am, &c., ROBERT FITZ ROY.

Athenæum Club, Nov. 2.

It was only on Friday last (being from home) that I had an opportunity of seeing the article in the *Athenæum* of October 28, by Mr. Airy, in which my name repeatedly appears, "On the Correction of the Compass in Iron Ships." The elegance of the investigations of Mr. Airy on the magnetical condition of the "*Rainbow*," having been known to me, and, I may add, fully appreciated by me from the time of the first publication of the results, it is no small satisfaction to me to have the opportunity thus given by that article, for the fair discussion of the principles and mode of working of the method of compass adjustment by permanent magnets, on which we, unfortunately, so greatly differ at present. The discussion will, I doubt not, be of much use in carrying forward the movement, which the case of the "*Tayleur*," deemed by Mr. Airy to have been unfortunately selected, has, I believe, most fortunately given rise to. Good, I am persuaded, has been already obtained in this most enterprising port from what has already been done, and still further good may be expected from a calm and candid discussion of the questions betwixt us.

At present, however, whilst from home, it is not in my power to go into a subject so important to commerce and humanity satisfactorily. But shortly I shall beg some space in your columns, in order to state the grounds on which I have arrived at conclusions so different from those stated in the article referred to; and to endeavor to establish the views of the case which so long I have been publicly urging, and which, if so established, must be held to possess a high degree of importance in their bearing on so great a national interest as the safety of the navigation of ships built of iron. I am, &c., WILLIAM SCORESBY.

Liverpool, Nov. 8.

(To be Continued.)

For the Journal of the Franklin Institute.

Comparison of the Performance of the U. S. Steamers Mississippi, Susquehanna, and Powhatan.

By the kindness of one of the engineers attached to the Japan Squadron in 1854, we are enabled to present an interesting comparison of the performance of the above named steamers, abstracted from their steam logs, during a cruise, side by side, from Loo Choo to Japan, February 7th to 13th, 1854, during the whole of which time they were within hailing distance, and, of course, influenced by the same winds, currents, &c. It is rarely that such opportunities occur, or that when they do occur, such accounts are kept of the conditions of the engineering department as can be relied upon. Taken in connexion with the dimensions, &c., of the respective vessels previously furnished in this Journal, the abstract given below will not be devoid of interest or instruction.

Steamer Mississippi.

				Per hour.			
Date.	Hours of steaming.	Steam pressure in pounds per square inch.	Revolutions per minute.	Pounds of coal.	Speed, in feet of wheels.	Speed, in feet of ship.	Slip of wheel in per ct.
Feb. 7,	12	10·85	8·74	2560	45,032	38,635	14·2
" 8,	24	9·20	8·60	2174	44,250	43,379	0·5
" 9,	24	6·33	9·67	1583	49,627	48,845	0·4
" 10,	24	8·43	8·93	2230	45,827	41,532	9·3
" 11,	24	11·90	8·61	3030	44,738	34,489	22·9
" 12,	11	12·18	7·76	2804	39,976	23,297	41·7

Steamer Powhatan.

Feb. 7,	13	12·60	8·58	3231	46,630	35,820	23·0
" 8,	24	11·16	9·11	3411	49,568	43,379	12·5
" 9,	24	——	9·77	2528	53,096	48,845	8·0
" 10,	24	10·71	8·86	3183	48,694	41,532	14·7
" 11,	23	12·43	8·84	3990	48,310	35,980	25·5
" 12,	10	11·64	7·78	3359	41,392	23,297	43·7

Steamer Susquehanna.

Feb. 7,	13	9·46	9·04	3241	47,609	35,820	24·7
" 8,	24	9·32	9·32	2970	49,462	43,379	12·3
" 9,	24	9·92	8·86	3475	51,614	48,845	5·3
" 10,	24	9·46	9·20	3010	50,818	41,532	18·3
" 11,	24	9·92	8·86	3975	47,054	34,489	26·7
" 12,	11	9·64	7·99	3682	42,426	23,297	45·1

Averages.

Mississippi, .	9·44	8·84	2336	45,330	39,982	11·79
Powhatan, .	14·60	8·96	3248	48,781	39,932	18·05
Susquehanna, .	9·63	8·96	3310	48,840	39,648	18·82

From the above tables it will be seen, that the performance of the

Powhatan and *Susquehanna* was nearly identical, but slightly in favor of the latter, and that in both, the slip was over 50 per cent. more than in the *Mississippi*. The draft of water and dip of the wheels was not noted on any of the logs, which prevents our knowing the displacement of the vessels; it is however probable, that all of them drew the average on sea service, and, therefore, that the comparison of their performance is a fair one. M.

For the Journal of the Franklin Institute.

Experiments on the Paddle Wheels of the U. S. Steam Frigate "Mississippi," to Determine the Influence Exerted on their Slip by the Omission of every other Paddle. By B. F. Isherwood, Chf. Eng. U. S. N.

During the Mediterranean cruise of the U. S. steam frigate "*Mississippi*," in the years 1849, 1850, and 1851, an experiment was made by her chief engineer, Jesse E. Gray, U. S. N., to determine the influence on the slip of her paddle wheels by the omission of every other paddle.

The "*Mississippi*" had occasion, in the course of this cruise, to make a number of short passages between Spezzia and Leghorn, along "the tideless shores of the Mediterranean," a distance of 37½ geographical miles of 6085 feet. These passages were all made in fine weather with light airs and smooth sea. The results were reasonably uniform; the vessel's draft of water and the immersion of the paddles not varying enough throughout to sensibly affect them. The mean of eight passages, made with the full number of twenty-one paddles in each wheel, the total number of revolutions made by the wheels being taken by a counter, gives accurate data for the slip with the paddle wheels in their normal condition. After seven passages had been thus made, with considerable intervals of time between them, every other paddle was removed, reducing the number to eleven in each wheel in place of twenty-one, necessarily leaving two in their original juxtaposition from the odd (21) number of the original paddles. One passage was made with the paddles in this condition with weather quite as fine and under circumstances quite as favorable as before; the total number of revolutions made by the wheels was ascertained by the counter as before. This last performance was not repeated from prudential motives, for the concussion and shock on the water of the entering paddles, now that they were removed so far apart, produced so excessive a vibration and shaking of every part of the vessel as to be very uncomfortable to the persons on board:—the paddles struck the water as though it were a solid rather than a fluid substance. And this was the more remarkable, because with the twenty-one paddles in each wheel not the slightest vibration of the hull had ever been experienced from the action of the machinery; the "*Mississippi*" being noted for solidity and steadiness. The alternate paddles were now restored, and during the last passage between the same points and under the same conditions of weather, &c., as before, the first results were again obtained; the vibration and shaking of the hull and the violent concussions of the entering paddles on the water, entirely ceased with the restoration of the original paddle surface.

During these experiments the vessel's mean draft of water averaged 18 feet 11 inches. The paddle wheels were 29 feet diameter from outside to outside of paddles—the paddles were 11 feet in length by 22 inches in width. For further details and dimensions of the "*Mississippi*," see Vol. xxiv. of this Journal, p. 384. The following are the dates of the passages, together with the total number of revolutions made during each passage by the paddle wheels—this number was taken by a counter receiving its motion from the engines. The time of making the passages, steam pressures, &c., though not observed with precision, were about the same throughout.

Date.	Passage.	Number of revolutions made by the paddle wheels as taken by the counter.
	Steaming with 21 *Paddles in each Wheel.*	
September 10, 1849,	From Leghorn to Spezzia, . .	3170
November 17, "	" Spezzia to Leghorn, .	2920
" 25, "	" Leghorn to Spezzia, . .	2940
" 27, "	" Spezzia to Leghorn, .	3050
April 23, "	" " " " . .	2960
October 14, 1850,	" " " " . .	3050
" 19, "	" Leghorn to Spezzia, . .	2980
May 31, 1851,	" " " " . .	3020
	Mean of the eight passages, .	3011
	Steaming with 11 *Paddles in each Wheel.*	
April 19, 1851,	From Leghorn to Spezzia, . .	3536

With the above data, making the calculations for the slip of the centre of pressure of the paddles, we obtain the following results, viz:

Slip when steaming with 21 paddles in each wheel, 12·79 per centum.
" " " 11 " " 25·74 " "

From the above it will be perceived, that halving the number of paddles in each wheel by the omission of every other one, just doubled the slip. But few readers will probably have expected such a result, as the prevailing opinion is that such an omission of paddles would affect the slip to only an inconsiderable degree. But beside the incontestible evidence of the self-registering counter, there is the strongly marked effect produced upon the heavy and solid live oak hull. With 21 paddles in each wheel, the paddles at their periphery were 4·338 feet from centre to centre; with 11 paddles in each wheel, they were 8·676 feet from centre to centre; this latter distance seems great enough to enable an intermediate paddle to act with full effect without enfeeblement from the adjacent ones. The entering paddle struck the water at an angle of 57° from the perpendicular, making the angle included between the paddle and water level 33° only. Under these conditions, the mean loss of useful effect by the oblique action of the paddles on the water, calculated for every 10° and as the squares of the series of their angles of incidence on the water, was 25·77 per centum of the power applied to them.

For the Journal of the Franklin Institute.

Steam Blow-Pipes. By R. J. Nunn, M. D., Savannah, Ga.

In No. 41 *Scientific American*, mention is made of a furnace for chemical analysis, lately patented in England. Some years ago in a laboratory, which was at that time in my possession, there were several plans in operation for using steam to supply the place of the table blow-pipe. They were convenient, and capable of producing a very high temperature. As perhaps some of your readers may be interested in the use of such an instrument, a description of the most useful of them may be acceptable.

As at times, gas could not be procured, alcohol was sometimes used, but the expense of this fluid prevented its employment on all occasions, so that when coal gas was not obtainable, oil or tallow was occasionally brought into requisition; for these reasons, a burner was provided for each, which were all adaptable to the same boiler; the furnace in which gas was employed, involved precisely the same principle as that claimed by the English patentee.

The boiler was a copper vessel, capable of holding about four gallons, (a part of a distilling apparatus;) a supply pipe descended within, and at one side to about an inch from the bottom, and projected about two inches above the vessel, terminating in a stop-cock, to which was attached about five feet of vulcanized india-rubber tube; a glass tube placed vertically on outside, one extremity of which was on a level, and communicated with the bottom, while the other rose to the same height, and was connected with the top of the vessel, served to indicate the height of the water in the interior; a safety valve and steam pipe completed the arrangement. The safety valve which was first used, consisted of a glass tube bent at two right angles, so that while one extremity was connected with the top of the boiler, the other dipped into a cup of mercury, by varying the depth to which the tube descended in the quicksilver; the pressure was increased or diminished at pleasure; subsequently a valve of the usual construction was employed.

The burner used with gas, was one belonging to an oxyhydrogen blow-pipe, the steam passing through the oxygen jet, and the gas entering the one used for hydrogen.

When volatile liquids were more convenient, the steam before escaping at the jet, was made to heat the chamber containing the wick, and the vapor thus obtained was used as gas. When the burner was at a distance from the fluid, it was found convenient to keep the steam and gas pipes in contact, and, furthermore, to envelop them in some non-conducting material, to prevent condensation.

When oil was employed, a jet of steam was made to issue from the centre of the wick. In all cases it was found more serviceable to have the steam jet in the centre of the flame.

To set the apparatus in action, the boiler was first half filled with water, (the height being determined by the glass tube,) which being made to boil, the pressure was regulated to the required degree; the supply pipe was next maintained in a perpendicular position, and a stream of water sufficient to equal the evaporation, was admitted by the stop-cock, (if a pressure more than two pounds per square inch, was at any time desired, the supply pipe was of course proportionately lengthened;) the gas was then lit, and finally, the steam let on. By regulating the proportions between the pressure, the supply of steam, and that of gas, any desired variation could be obtained.

When fluids, (such as alcohol, naphtha, &c.,) were used, the steam was allowed to pass through the jet a few moments, to cause some evaporation; it was then stopped off, the vapor ignited, and the steam again let on. The burner had to be kept above the level of the boiler, otherwise the condensed steam accumulated and interfered with the steadiness of the blast.

It is to be hoped, our chemical instrument makers will manufacture some apparatus on this principle, as it is exceedingly convenient, and can be made in connexion with the still-body, like the one just described; arrangements should also be supplied suitable to each kind of burning material.

On the Construction and Proper Proportions of Boilers for the Generation of Steam.[*] By Andrew Murray, Chf. Eng. of Her Majesty's Dock Yard, Portsmouth.

Mr. Muir, in his paper on the Smoke Nuisance, read before the Society on the 17th of January, referred, and other parties have done the same, to a want of definite rules for the relative dimensions for the flues and other parts of steam engine boilers. In 1844, in a paper read before the Institution of Civil Engineers, Mr. Andrew Murray gave the results which he had arrived at, on these points, after long observation and much consideration. As his experience since 1844 has confirmed him in the opinions then expressed, he has enclosed to the secretary a copy of the paper, from which the following extracts are taken.

"The supply of the requisite quantity of air to the fuel on the bars, being of the utmost importance, it is usual to make the ash-pit, and the entrance to it, as large, and as free, as the situation will allow. In marine boilers, or wherever it is necessary to limit the size of the ash-pit, the area for the entrance of the air into it, should never be less than one-fourth part of the area of the grate, and in order to facilitate the supply to the back part of the grate, the bars should be made to incline downwards to the extent of about one inch in a foot. No advantageous results will be obtained from increasing the ash-pit, as is sometimes done in land boilers, to a very great extent, by making it 5 or 6 feet deep; about 2½ feet is sufficiently deep, even supposing that the ashes are not cleared out oftener than once a day.

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[*] From the Journal of the Society of Arts, February, 1855.

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"The extent of "dead plate" in front of the furnace is not material, as respects combustion; in marine boilers, it is generally not more than about 6 inches broad, which is the width of the water space between the fire and the front of the boiler; but in land boilers it is frequently required to be very broad, to support the brick-work, especially in those cases where the flue is carried across the front.

"The amount of the opening between the bars, should be about $\frac{7}{16}$ths of an inch, but this must be regulated by the kind of coal to be burnt upon them; but for any kind of coal, it should not be less than $\frac{3}{8}$ths of an inch, nor more than $\frac{1}{2}$ an inch. If the space were made larger, the waste from the amount of cinders, or of small pieces of coke, which would fall through in a state of incandescence, would be considerable; otherwise it would be preferable to have a larger space. In order to facilitate the supply of air, each bar should be as thin as is consistent with the strength required. The bars in general use in this country, are 1 inch or 1$\frac{1}{8}$ inch in thickness, but it would be much more advantageous to use them thinner, as in France, where they are frequently used not more than $\frac{1}{2}$ inch thick.

"The advantage of a considerable amount of space in the furnace, over the fire-bars, has been already mentioned, but no very decisive experiments have been made on this subject. Three cubic feet of space to each superficial foot of grate bar surface, may be stated as a good proportion where there is nothing to prevent this amount being obtained. When the space is reduced below one foot and a half to each foot of grate, it will be found to be attended with a marked disadvantage.

"The area of the flue, and subsequently of the chimney through which the products of combustion must pass off, must be regulated by their bulk and their velocity. The quantity of air chemically required for the combustion of one pound of coal, has been shown to be 150·35 cubic feet, of which 44·64 enter into combination with the gases, and 105·71 with the solid portion of the coal. From the chemical changes which take place in the combination of the hydrogen with oxygen, the bulk of the products is found to be to the bulk of the atmospheric air required to furnish the oxygen, as 10 is to 11. The amount is therefore 49·104. This is without taking into account the augmentation of the bulk due to the increase of the temperature. In the combination which takes place between the carbon and the oxygen, the resultant gases (carbonic acid gas and nitrogen gas) are of exactly the same bulk as the amount of air, that is, 105·71 cubic feet, exclusive, as before, of the augmentation of bulk from the increase of temperature. The total amount of the products of combustion in a cool state would therefore be

$$49{\cdot}104+105{\cdot}71=154{\cdot}814 \text{ cubic feet.}$$

"The general temperature of a furnace has not been very satisfactorily ascertained, but it may be stated at about 1000° Fahrenheit, and at this temperature, the products of combustion would be increased, according to the laws of the expansion of aeriform bodies, to about three times their original bulk. The bulk, therefore, of the products of combustion which must pass off, must be $154{\cdot}814\times3=464{\cdot}442$ cubic feet. At a velocity of 36 feet per second, the area, to allow this quantity to pass off in an hour, is ·516 square inch. In a furnace in which 13 lbs. of coal are burnt on a square foot of grate per hour, the area to every foot of grate would be ·516 × 13 = 6·708 square inches; and the proportion to each foot of grate, if the rate of combustion be higher or lower than 13 lbs., may be found in the same way.

"This area having been obtained, on the supposition that no more air is admitted than the quantity chemically required, and that the combustion is complete and perfect in the furnace, it is evident that this area must be much increased in practice, where we know these conditions are not fulfilled, but that a large surplus quantity of air is always admitted. A limit is thus found for the area over the bridge, or the area of the flue immediately behind the furnace, below which it must not be decreased, or the due quantity could not pass off, and consequently the due quantity of air could not enter, and the combustion would be proportionally imperfect. It will be found advantageous in practice to make the area 2 square inches instead of ·516 of a square inch. The imperfection of the combustion in any furnace, when it is less than 1·5 square inch, will be rendered very apparent by the quantity of carbon which will rise unconsumed along with the hydrogen gas, and show itself in a dense black smoke on issuing from the chimney. This would give 26 square inches of area over the bridge to every square foot of grate, in a furnace in which the rate of combustion is 13 lbs. of coal on each square foot per hour, and so in proportion for any other rate. Taking this area as the proportion for the products of combustion, immediately on their leaving the furnace, it may be gradually reduced, as it approaches the chimney, on account of the reduction in the temperature, and consequently in the bulk of the gases. Care must, however, be taken that the flues are nowhere so contracted, nor so constructed as to cause, by awkward bends, or in any other way, any obstruction to the draft, otherwise similar bad consequences will ensue.

"An idea is very prevalent that it is advantageous to make the flame or hot gases (as they may be termed, because we may look upon flame merely as a stream of gases heated to incandescence) impinge upon, or strike forcibly the plates of a boiler, at any bend or change of direction in the flue. The turn in the flue is, therefore, made with a square end, and with square corners; but it is difficult to see on what rational grounds the idea of advantage can be upheld. The gases, if they are already in contact with the plate, cannot be brought closer to it, and any such violent action is not necessary to alter the arrangement of the particles of the gases and bring the hotter particles to the outside; while there is a great risk of an eddy being formed and of the gases being thrown back and returned upon themselves, when they strike the flat opposing surface; thus impeding the draft and injuring the performance of the boiler. That circulation will take place to a very great extent, among the particles of heated gases, flowing in a stream even in a straight flue, will be apparent from those particles next the surface being retarded, by the friction against the sides and by their tendency to sink into a lower position in the stream, from their having been cooled down and become more dense. An easy curve is sufficient to cause great change in the arrangement of the particles, as those which are towards the outside of the bend, have a much longer course to travel, and are thus retarded in comparison with the others. From these causes the hotter particles in the centre of the flowing mass, are in their turn brought to the outer surface and made to give out their heat. The worm of a still is never found returning upon itself with square turns, as if the vapor inside would be more rapidly cooled by its impinging on the opposite surface; yet the best form of worm is a subject which has engaged the attention of many able men, and therefore may well be taken by engineers as a guide in the management of a similar process, though carried on at a much higher temperature.

"Another very prevalent practice and which also would seem to be open to serious objections, is, that the flues are frequently made of much greater area in one part than in another. This arises from a desire to obtain a larger amount of heating surface, than is consistent with the proper area of the flue, or with the amount of the heated gases which are passing through it. The flue is thus made shorter in its course than it ought to be in proportion to its sectional area. This is even sometimes done, by placing a plate of iron partly across the flue, near the bottom of the chimney, thus suddenly contracting the passage for the gases. The effect of this is evidently to cause a very slow and languid current, in the larger part of the flue, and the consequence is, that a deposition of soot rapidly takes place there. In many marine and land boilers, having one internal flue in them, of too large a size, this will be found to be the case, soot being soon deposited, till the flue is so filled up that the area left is only such as is due to the quantity of heated gases passing though it; the value of those parts of the sides of the flue which are covered with soot is thus lost. * * * * *

"When the gases have reached the foot of the chimney, in a well-proportioned boiler, they will be found to be reduced to a temperature of about 500° Fahrenheit, or below it; their bulk will, in consequence, be reduced by about ⅓d below their bulk on their first leaving the furnace. The reduction in the area of the flue, ought not to be in the same proportion, because their velocity is no longer so great. The reduction ought to be made gradually, as has been stated before, and not by a sudden contraction at the foot of the chimney; as the effect of this is to cause a slowness of draft in the latter part of the flue and consequently a deposition of soot; and then the surface, so covered, which had been reckoned upon as effective heating surface, is lost. The area of a chimney to allow the products of the combustion of each pound of coal consumed in an hour, to pass off, should be not less than ¾ths of 2 square inches, this latter being the area given for the flue, immediately behind the fire-place—that is, 1½ square inch; and for a boiler burning 13 lbs. of coal per hour on each superficial foot of its grate, the area should be ¾ths of 26 square inches, or 19½ square inches.

"Theoretical research not having as yet given us any valuable assistance, in determining the proper height of a chimney, we must again refer to practice as our guide. A good draft may be obtained with a very low chimney, but at a great expenditure of fuel, from the necessity that exists in such a case for allowing the gases to pass off at a much higher temperature than would otherwise be necessary. For a chimney built of brick-work, the height ought not to be less than 20 yards, and may be increased to 30 yards or 40 yards, with advantage in the economy of fuel. When chimneys are carried to a still greater height, it is generally for the purpose of carrying off the smoke, or any deleterious gases, from the immediate neighbourhood, or to create a good draft with gases at a lower temperature, than those from a steam-boiler furnace. On board steam vessels chimneys are limited in their height by the size of the ship, on account of the influence the chimney has on the stability and appearance. It will generally be found advantageous to make the chimney as high as these circumstances will permit."

*Tempering of Steel.**

In the discussion on Mr. Sanderson's paper, "On the Manufacture of Steel," an inquiry was made as to the kind of steel suitable for particular articles, and how its quality might be tested. This gave rise to the remark that the tempering of steel depended on the skill and experience of the workman. Mr. Harry Scrivenor, of Liverpool, has, however, obtained from a clever workman the following memoranda on the subject:—

"I received your letter inquiring what steel was best for different kinds of manufactures. I should say cast steel, if it can be applied; double shear for hatchets, or any kind of edge tool that cannot be well made of cast steel. The temper to be as follows:—

"1st. For boring cylinders, turning rolls, or any large cast iron, let it be as hard as water will make it, minding not to heat it more than a cherry red.

	Deg. Fahr.
2d. Tools for turning wrought iron, pale straw color,	430
3d. Small tools for ditto, shade of darker yellow,	450
4th. Tools for wood, a shade darker,	470
5th. Tools for screw taps, &c., still darker straw color,	490
6th. For hatchets, chipping chisels, brown yellow,	500
7th. For small rimers, &c., yellow, slightly tinged with purple,	520
8th. For shears, light purple,	530
9th. For springs, swords, &c., dark purple,	550
10th. For fine saws, daggers, &c., dark blue,	570
11th. For hand and pit saws &c., pale blue,	590

"The temper greatly depends on the quantity of carbon that is in the steel—this, the practical man soon finds out, and he tempers or draws down his tool accordingly."

Earth-Boring Machinery.†

A paper on this subject by Mr. Colin Mather, was read at the Society of Arts on the 30th May, 1855, in the course of which various modes of boring artesian wells were described, and especially a new plan now being brought into operation by Messrs. Mather and Platt.

The construction of the boring head and shell pump, and the mode of acquiring the percussive motion, constitute the chief novelties of the system and machine. The couple cylinder engine, with the reversing or link motion, is used for winding and lowering apparatus, but an ordinary winding engine, similar to those used in collieries, may be applied.

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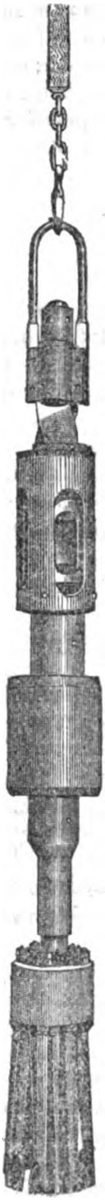
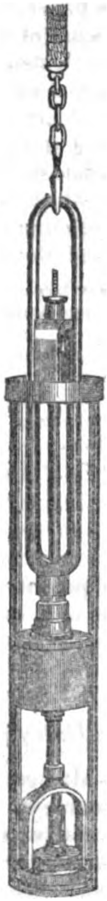
* From the Lond. Journal of the Society of Arts, May, 1855.

† From the Lond. Builder, No. 644.



BORING HEAD.



SHELL PUMP.

The boring head consists of a wrought iron bar, about 8 feet long, on the lower part of which is fitted a block of cast iron, in which the chisels or cutters are firmly secured. Above the chisels an iron casting is fixed to the bar, by which the boring head is kept steady and perpendicular in the hole. A mechanical arrangement is provided, by which the boring head is compelled to move round a part of a revolution at each stroke. The loop or link by which the boring apparatus is attached to the rope is secured to a loose casting on the wrought iron bar, with liberty to move up and down about 6 inches. A part of this casting is of square section, but twisted about one-fourth of the circumference. This twisted part moves through a socket of corresponding form on the upper part of a box, in which is placed a series of ratchets and catches, by which the rotary motion is produced. Two objects are here accomplished—one the rotary motion given to the boring head, the other a facility for the rope to descend after the boring head has struck, and so prevent any slack taking place, which would cause the rope to dangle against the side of the hole, and become seriously injured by chafing.

The shell-pump is a cylinder of cast iron, to the top of which is attached a wrought iron guide. The cylinder is fitted with a bucket similar to that of a common lifting-pump, with an india rubber valve. At the bottom of the cylinder is a clack, which also acts on the same principle as that in a common lifting-pump, but it is slightly modified to suit the particular purpose to which it is here applied. The bottom clack is not fastened to the cylinder, but works in a frame attached to a rod which passes through the bucket, and through a wrought iron guide at the top of the cylinder, and is kept in its place by a cotter, which passes through a proper slot at the top of the rod. The pump-rod, or that by which the bucket is worked, is made of a forked form, for the two-fold purpose of allowing the rod to which the bottom clack is attached to pass through the bucket, and also to serve as the link or loop by which the whole is suspended.

The wrought iron guide is secured to the top of the cylinder, and prevents the bucket from being drawn out when the whole is so suspended. The bottom clack also is so arranged that it is at liberty to rise about six inches from its seating, so as to allow large fragments of rock, or other material, to have free access to the interior of the cylinder when a partial vacuum is formed there by the up stroke of the pump.

The percussive motion is produced by means of a steam cylinder, which is fitted with a piston of 15 inches diameter, having a rod of cast iron 7 inches square branching off to a fork, in which is a pulley of about 3 feet in diameter, of sufficient breadth for the rope to pass over, and with flanches to keep it in its place. As the boring head and piston will both fall by their own weight when the steam is shut off, and the exhaust valve opened, the steam is admitted only at the bottom of the cylinder: the exhaust port is a few inches higher than the steam port, so that there is always an elastic cushion of steam of that thickness for the piston to fall upon.

The valves are opened and shut by a self-acting motion derived from the action of the piston itself, and as it is of course necessary that motion should be given to it before such a result can ensue, a small jet of steam is allowed to be constantly blowing into the bottom of the cylinder: this causes the piston to move slowly at first, so as to take up the rope, and allow it to receive the weight of the boring rod by degrees, and without a jerk. An arm which is attached to the piston-rod then comes in contact with a cam, which opens the steam-valve, and the piston moves quickly to the top of the stroke. Another cam, worked by the same arm, then shuts off the steam, and the exhaust valve is opened by a corresponding arrangement on the other side of the piston-rod. By moving the cams the length of the stroke can be varied at the will of the operator, according to the material to be bored through. The fall of the boring head and piston can also be regulated by a weighted valve on the exhaust pipe, so as to descend slowly or quickly, as may be required.

The general arrangement of the new machine may be described as follows:—

The winding drum is 10 feet in diameter, and is capable of holding 3000 feet of rope, 4½ inches broad and half an inch thick: from the drum the rope passes under a guide pulley, through a clam and over the pulley which is supported on the fork end of the piston-rod, and so to the end which receives the boring head, which being hooked on and lowered to the bottom, the rope is gripped by the clam. A small jet of steam is then turned on, causing the piston to rise slowly until the arm moves the clam, and gives the full charge of steam: an accelerated motion is then given to the piston, raising the boring head the required height, when the steam is shut off, and the exhaust opened in the way described, thus effecting one stroke of the boring head as regulated by a back pressure valve in the exhaust pipe. The exhaust port is 6 inches from the bottom of the cylinder: when the piston descends to this point it rests on a cushion of steam, which prevents any concussion. To increase the lift of the boring head or compensate for the elasticity of the rope, which is found to be 1 inch in 100 feet, it is simply necessary to raise the cams on the cam shaft whilst the percussive motion is in operation. The clam which grips the rope is fixed to a slide and screw, by which means the rope can be given out as required. When this operation is completed, and the strata cut up by a succession of strokes thus effected, the steam is shut off from the percussive cylinder, the rope unclamped, the winding engine put in motion, and the boring head brought up and slung from an overhead suspension bar by a hook fitted with a roller to traverse the bar. The shell pump is then lowered, the *débris* pumped into it, by lowering and raising the bucket about three times, which the reversing motion of the winding engine readily admits of. It is then brought to the surface and emptied by the following very simple arrangement. At a point in the suspension bar a hook is fixed perpendicularly over a small table in the waste tank, which table is raised and lowered by a screw. The pump being suspended from the hook hangs directly over the table, which is then raised by the screw till it receives the weight of the pump. A cotter, which keeps the clack in its place, is then knocked out, and the table screwed down. The bottom clack and the frame descending with it, the contents of the pump are washed out by the rush of water contained in the pump cylinder. The table is again raised by the screw, and the clack resumes its proper position: the cotter is then driven into the slot, and the pump is again ready to be lowered into the hole as before. It is generally necessary for the pump to descend three times in order to remove all the *débris* broken up by the boring head at one operation.

The following facts, obtained from the use of the machine in boring in the new red sandstone at Manchester, will show its actual performance, and enable us to compare it with the other systems mentioned in this paper. The boring head is lowered at the rate of 500 feet a minute: the percussive motion is performed at the rate of twenty-four blows a minute; and, being continued for ten minutes, the cutters in that time penetrate from 5 to 6 inches: it is then wound up at 300 feet a minute. The shell pump is then lowered at the rate of 500 feet a minute, the pumping continued for one minute and a half, and being charged, the pump is wound up at 300 feet a minute. It is then emptied, and the operation repeated, which can be accomplished three times in ten minutes, at a depth of 200 feet. The whole of one operation, resulting in the deepening of the hole 5 to 6 inches, and cleansing it of the *débris* ready for the cutters or boring head being again introduced, is seen to occupy an interval of twenty minutes only. The value of these facts will be best shown by comparing them with the results by the old method.

At Highgate the boring has occupied two years in attaining a depth of 680 feet from the bottom of a well 500 feet deep from the surface. Their progress at present is at the rate of 6 inches per week, working night and day. At Warwick, thirteen months were occupied in boring 400 feet through red marl; at Saltaire, two years in going 80 yards.

Some of the more important public uses to which the new machine can be applied may now be briefly enumerated.

Sanitary questions deservedly occupy at the present time a large share of public attention. Water, as is well known, is the chief agent in sanitary reform. It is necessary for flushing sewers, for supplying baths and wash-houses, as well as for meeting the domestic wants of all classes of the community. The importance of cleanliness cannot be overrated, as a means of promoting the general health, and it imposes the necessity for a much more copious supply of pure water than is as yet enjoyed in most towns. Many small towns which are so situated that they cannot command a supply of water from natural sources, are prevented from obtaining it by boring, on account of the great expense, and still more the vexatious uncertainty of the process. The corporation of Manchester have expended upwards of a million sterling in supplying that city and its neighborhood with water, and they sell it to the corporation of Salford at the rate of three pence per thousand gallons. It is confidently believed that by the new method of boring, an abundant supply of water could be procured on the spot at half that price. Thus, in a sanitary point of view, the new machine is of the utmost value, since it enables us to procure a much greater supply of water in far less time, and from depths which were all but inaccessible on the old method of boring. For example, the work at Highgate, which has occupied two years, could have been done in thirty-three days. That at Warwick, which has occupied thirteen months, could have been done in twenty days. That at Saltaire, to supply the work-people with drinking water, which has occupied two years, could have been done in twenty-nine days.

On the Manufacture of Steel.[*]

A paper on the manufacture of steel, as carried on in different countries, was read on Wednesday evening, May 9, at the Society of Arts, by Mr. Charles Sanderson. After alluding to the antiquity of the manufacture, the composition of steel, and the raw materials from which it is prepared, the author proceeds as follows:

The kinds of steel which are manufactured are natural steel, called raw steel, or German steel; Paal steel produced in Styria, by a peculiar method; cemented, or converted steel; cast steel, obtained by melting cemented steel; puddled steel, obtained by puddling pig iron in a peculiar way.

Natural, or German steel, is so called because it is produced direct from pig iron, the result of the fusion of the spathose iron ores alone, or in a small degree mixed with the brown oxide; these ores produce a highly crystalline metal, called *spiegel eisen*, that is, looking-glass iron, on account of the very large crystals the metal presents. This crude iron contains about four per cent. of carbon, and four to five per cent. of manganese. Karsten, Hassenfratz, Marcher, and Reamur, all advocate the use of grey pig iron for the production of steel; indeed, they state distinctly that first quality steel *cannot* be produced without it; that the object is to clear away all foreign matter by working it in the furnace, to retain the carbon, and to combine it with the iron. This theory I hold to be incorrect, although supported by such high authorities. Grey iron contains the maximum quantity of carbon, and, consequently, remains for a longer time in a state of fluidity than iron containing less carbon; the metal is then mixed up, not only with the foreign matter it may itself contain, but also with that with which it may become mixed in the furnace in which it is worked. . This prolonged working, which is necessary to bring highly carbonized iron into a malleable state, increases the tendency to produce silicates of iron, which entering into composition with the steel during its production, renders it red short. Again, by the lengthened process, the metal becomes very tender and open in its grain; the molecules of silicate of iron which are produced will not unite with the true metallic part; and also, whenever the molecular construction of iron or steel is destroyed by excessive heat, it becomes unmalleable. Both these are the causes of red shortness, and also of the want of strength when cold. For these reasons I consider that grey pig iron is by no means the best for producing natural steel; and for the same reasons I should not recommend the highly carbonized white iron, although it is now used both in Germany and in France. In Austria, however, they have improved upon the general continental process; their pig iron is often highly carbonized, but they tap the metal from the blast furnace into a round hole, and throwing a little water on the surface, they thus chill a small cake about half an inch; this is taken from the surface, and the same operation is performed until the whole is formed into cakes; these cakes are then piled edgewise in a furnace, are covered with charcoal, and heated for 48 hours; by this process the *carbon* is very much discharged. By using these cakes in the refining, the steel is sooner made, and is of better quality. In the opinions I have given to many German steel makers, and in the advice I have offered them, I have endeavored to show that pig iron can only be freed from its impurities whilst in a fluid state. I take the advantage of the property of cast-iron, and previous to melting it in the steel refinery I submit it to a purification, by which process I seek to *reduce* the degree of carbonization of the metal, and to separate and dissolve the earthy matter with which it may be combined; I then obtain a purer metal for the production of steel. The metal itself being to some extent decarbonized, is sooner brought into "nature," as it is termed, that is, it sooner becomes steel. The process being shorter, and the metal itself being purer, there is less chance or opportunity for the formation of deleterious compounds, which, becoming incorporated with the steel, seriously injure its quality. Of course, steel manufactured from crude iron, either purified or not, of any defined quality, will inherit such quality, be it good or bad. Art can, in some degree, remove these noxious qualities from the crude iron. Chemistry has lent its powerful assistance, yet nature will maintain her sway, and in all cases the good or bad qualities of the metal will be transmitted to the steel.

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[*] From the Lond. Mechanics' Mag., May, 1855.

The furnaces in which raw or natural steel is manufactured are nearly the same, as far as regards their general construction, in all countries where such steel is produced; yet each country, or even district, has the fire in which the metal is worked differently constructed. We find, therefore, the German, the Styrian, the Corinthian, and many other methods, all producing steel from pig iron, yet pursuing different modes of operation. These differences arise from the nature of the pig the country produces, and the peculiar habits of the workmen. These modified processes do not affect the theory of the manufacture, but they rather accommodate themselves to the peculiar character of the metal produced in the vicinity. In Siegen they use the white carbonized, manganesian metal, while in Austria a grey or mottled pig iron is used.

Fig. 1.

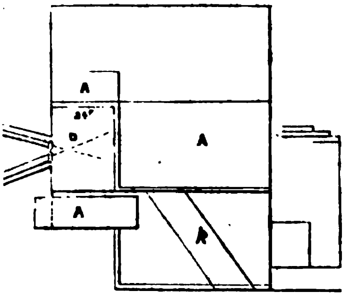
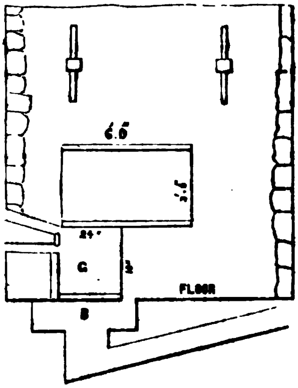


Fig. 2.



The furnace is built in the same form as a common charcoal refinery.

Fig. 1 shows a ground-plan of the furnace; fig. 2 an elevation; and fig. 3 the form of the fire itself and the position of the metal within it.

The fire, D, is 24 inches long and 24 inches wide; A, A, A, are metal plates surrounding the furnace.

Fig. 2 shows the elevation usually built of stone, and braced with iron bars. The fire, G, is 16 inches deep and 24 inches wide. Before the tuyere at B, a space is left under the fire, to allow the damp to escape, and thus keep the bottom dry and hot.

In fig. 1 there are two tuyeres, but only one tuyere iron which receives both the blast nozzles, which are so laid and directed that the currents of air cross each other, as shown by the dotted lines; the blast is kept as regular as possible, so that the fire may be of one uniform heat, whatever intensity may be required.

Fig. 3.

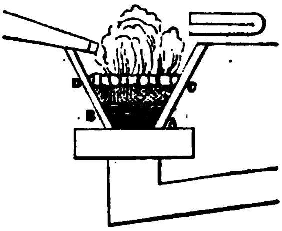


Fig. 3 shows the fire itself, with the metal, charcoal, and blast. A is a bottom of charcoal, rammed down very close and hard. B is another bottom, but not so closely beaten down; this bed of charcoal protects the under one, and serves also to give out carbon to the loop of steel during its production. C is a thin stratum of metal, which is kept in the fire to surround the loop. D shows the loop itself in progress. When the fire is hot, the first operation is to melt down a portion of pig iron, say 50 to 70 pounds, according as the pig contains more or less carbon; the charcoal is then pushed back from the upper part of the fire, and the blast, which is then reduced, is allowed to play upon the surface of the metal, adding from time to time some hammer slack, or rich cinder, the result of the previous loop. All these operations tend to *decarbonize* the metal to a certain extent; the mass begins to thicken, and at length becomes solid. The workman then draws together the charcoal and melts down another portion of metal upon the cake. This operation renders the face of the cake again fluid, but the operation of decarbonization being repeated in the second charge, it also thickens, incorporates itself with the previous cake, and the whole becomes hard; metal is again added until the loop is completed. During these successive operations the loop is never raised before the blast, as it is in making iron, but it is drawn from the fire and hammered into a large bloom, which is cut into several pieces, the ends being kept separated from the middle or more solid parts, which are the best.

This operation, apparently so simple in itself, requires both skill and care. The workman has to judge, as the operation proceeds, of the amount of carbon which he has retained from the pig iron; if too much, the result is very raw, crude, untreatable steel; if too little, he obtains only a steelified iron. He has also to keep the cinder at a proper degree of fluidity, which is modified from time to time by the addition of quartz, old slags, &c. It is usual to keep from two to three inches of cinder on the face of the metal, to protect it from the direct action of the blast. The fire itself is formed of iron plates, and the two charcoal bottoms rise to within nine inches of the tuyere, which is laid flatter than when iron is being made. The position of the tuyere causes the fire to work more slowly, but it insures a better result.

The quantity of blast required is about 180 cubic feet per minute, at a pressure of 17 inches water gauge. Good workmen make 7 cwt. of steel in 17 hours. The waste of the pig iron is from 20 to 25 per cent., and the quantity of charcoal consumed is 240 bushels per ton. The inclination of the tuyere is 12 to 15 degrees. The flame of the fire is the best guide for the workmen. During its working it should be a red blueish color. When it becomes white the fire is working too hot.

(To be Continued.)

On a new Manufacture of Compound Metallic Rods and Bars.

A paper on the above subject was recently read at the Institution of Mechanical Engineers, Birmingham, by Mr. E. J Payne, of that place. The following is an abstract of the author's remarks:

At a time like the present, when the high price of iron is of such importance to the consumers of rods and bars, descriptions of iron very extensively employed in many of the staple trades of this neighborhood, there may be some interest attached to the result of some experiments lately made with the view of producing an economical substitute for solid iron rods and bars, such as are mainly employed in the manufacture of fences, railing, hurdles, metallic bedsteads, and many other purposes.

* From the Lond. Mech. Mag., May, 1856.

The specimens exhibited, though somewhat crude, serve to elucidate the principle of the process.

They are small samples cut from lengths of rods and bars rolled in the following manner:—Two skelps of iron, A A, of the requisite weight, previously ascertained, are placed together to form a cylinder; and two similar skelps, B B, but of a somewhat larger size, are laid round this cylinder in such a manner as to break or cross the joints, as shown in fig. 1. The whole is then bound together with iron hoops or strong wire, and a short piece of solid metal driven into one end of this cylinder, which is then filled with sand, earth, or ashes, and well and tightly rammed and dried, after which the open end is plugged in the same way as the opposite one had been.

Fig. 1.

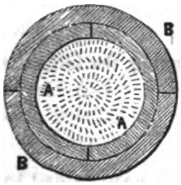


Fig. 2.

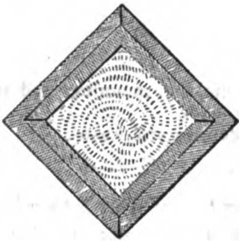
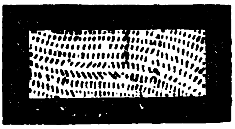


Fig. 3.



The billet thus charged is put in the furnace, and when at a sufficient heat is removed to the rolls, and rolled out precisely as solid iron, the sand core being reduced in very nearly the same proportion as the iron.

The exactness of this proportion depends entirely upon the thorough ramming of the core in the billet; for if the sand be loose, it follows that by the compression of the core in rolling, the iron makes up the deficiency in diameter, and a shorter length of rod than the billet was calculated to make is the result. Some of the specimens show this result clearly.

The area of sand in one of the billets shown, was one of iron to one of sand, or half sand, but after rolling and reducing it, it was found to have assumed the proportion of one and a half iron to one of sand, or only two-fifths sand.

It will be perceived by the specimens, that the sand during the process has become, by the heat and great pressure, a semivitreous body of exceeding hardness, so close in its texture as to bear a polish; and this appears to add (in conjunction with the tubular form of the metallic portion of the rod) very great additional strength;—for upon testing one of the specimens, about five-eighths of an inch in diameter, against a length of solid iron rod of the same diameter, by placing both upon benches, and suspending weights from the centre, the compound rod was found to sustain without deflexion a weight that nearly doubled up the solid rod.

Some of the rods produced, have been made from billets turned up into a cylinder from a flat skelp in gun barrel rolls, and one from the breech end of a twisted gun barrel; this was of course done merely as an experiment, as it appeared to be the worst description of tube for the purpose; the core, however, proved to be as sound as any of the rest. Generally speaking, the form of billet first described appears to be the best, and it is certainly the least expensive.

Thus far, the manufacture has been described of round rods. For square rods and flat bars, the same description of billet is employed, varying only in section; thus, for a square rod, a billet of the section, shown in fig. 2, composed of two skelps of a v form will be used; and for a flat bar, the section in fig. 3, made of skelps of angle iron would be employed, the operation of rolling being identical with that now in use for solid iron.

It now remains to show the result attained by these experiments, as to the saving of cost in the manufactured rod. The most complete estimate in the possession of the writer is one furnished from the works in South Wales, where the greater portion of these experiments have been made, which is the following:

Assuming the present price of the rolled skelps of the sections shown, to be

	£	s.	d.	
	9	10	0	per ton,
add	2	10	0	per ton, cost of making, ramming, and plugging the billets, including cost of sand.
add	1	0	0	per ton for contingencies and waste.
	£13	0	0	

Total cost of working up one ton of iron into a length equivalent to that which would be produced from two tons of solid iron; giving the price of the rods or bars containing half sand, 6*l.* 10*s.* per ton measurement, or a saving of about 3*l.* for the same length of rod or bar. But it should be remembered that these experiments have been confined to the production of rods not exceeding one inch in diameter, and that as the diameter of the rod increases, a considerably greater proportion of sand than one-half can be introduced: consequently a ton of iron may be made to produce more than two tons measurement of the larger rods or bars. This estimate of the saving on an average of all marketable sizes, would therefore be rather within the mark than otherwise.

Certain samples of railway rails upon the table were also rolled at the Cwm Avon works in South Wales, with a view of testing the applicability of the invention to effect a saving of metal in this branch of manufacture. Also, certain piles were made in the usual manner, with upper and lower plates of No. 2 iron, the remainder being puddled bars, and having a hollow in the centre, for the reception of the core; the sand was in this case first rammed in a core box, made of plate iron, ¼-inch thick. In one of these piles the core was 4¼ inches, the other, 3¼ inches square, but the ends were left unplugged; the result of the rolling showed that the sand assumed very much the form of the rail, but from the omission of the plugging, the area of the section of sand in the rails is not nearly so great in proportion as that of the one introduced in the pile.

Some samples of small copper tubes, made on the same principle as the iron rods, are also shown among the specimens, the only difference in their manufacture being, that the billets were in this case drawn cold; consequently, the sand not being vitrified, was readily removed afterwards from the bar, leaving it an open tube; but these may be more easily made by charging the billets (the cylinders for which are cast as shown by the specimen exhibited) either of pure silica or plaster of paris, neither of which will vitrify, and then rolling them hot in the same manner as the iron rods. This kind of core undergoing no change by the action of the fire, may be bored out with ease.

Further experiments are now being made, with the endeavor to produce rods having a mere skin of iron on the strong core, the result of which the writer will be happy to communicate on a future occasion.

*The High-Pressure Boilers of Her Majesty's Ship "Pembroke," of Sixty Guns.**

The accompanying drawings of the boilers of Her Majesty's Ship *Pembroke*, will, we trust, be acceptable to our readers. These boilers have been made by Messrs. Maudslay, Sons & Field, and are worthy of the high professional reputation of that firm.

Fig. 1, is a sectional elevation;
Fig. 2, a plan;
Fig. 3, a transverse section, across furnaces;
Fig. 4, a transverse section, showing arrangement of tube centres; and
Fig. 5, an end view of boilers, showing position occupied in the ship.

Length of tubes,	8′ 1″		
Diameter of tubes,	2 inches outside.		
Number of tubes,	864.		
Fire-grate surface,	120 ft. =		·6 per H.P.
Tube,	3654 ft. =	18·27	= 19·87 per H. P.
Flue,	320 ft. =	1· 6	
Square inches in funnel,	1256 =		6· 3 per H. P.

While the universal public are denouncing in no measured terms, the bungling and blundering, which have been so awfully fatal to our small but brave army in the Crimea; and while there is a general feeling that professional men do not meet with that encouragement and success in the service of their country, when not backed and supported by other influences than those of *merit* and *fitness* alone (hence the introduction into the public service of so many bunglers); and while it is true that, as a whole, the public service has but seldom taken the lead in any great improvement in the practical application of science,—we do the more

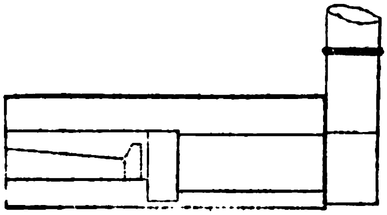


Fig. 1.—Sectional elevation.

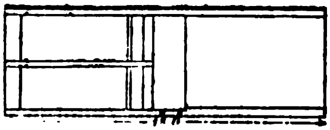


Fig. 2.—Plan. Scale ⅛ = 1 foot.

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* From the London Artizan, April, 1855.

cheerfully note that in so far as regards the introduction of high-pressure steam, the Steam Department of the Royal Navy deserves no small meed of praise, as taking the lead in a very important improvement in practical science.

There have been, with many of our engineers, of long standing and of high professional reputation, a dread of and a prejudice against the use of high-pressure steam; but its peculiar and valuable properties, when applied to the marine engine, are now so self-evident, that we feel quite confident that this dread and that prejudice will ere long be dispelled, and that it will become universal both in our Commercial as well as in our Royal Navy.

It is an old and trite saying, that necessity is the mother of invention. The immense value of steam-power in a ship-of-war was clearly developed in the Baltic campaign of last year, and, in anticipation of the work of the coming season, the Admiralty have converted about half-a-dozen old 74-gun sailing ships, in the course of a very few months, into good, useful steamships. The *Pembroke* is one of this class. She now carries 60 guns on two decks. The engines are simple, strong, and at the same time very compact, of 200 nominal horses power: the cylinders are 30 inches diameter; the length of stroke is 2 feet 6 inches. The boilers have been tested to 180 lbs. on the square inch; and if care be taken to make good pipes, good joints, and very simple boiler-mountings, we have every confidence that the results from the *Pembroke* will be very satisfactory indeed.

It will be observed that the tops of the boilers are considerably below the water-line, and it is just possible that these boilers may prime. If so, we would suggest that a steam-chest, or steam-reservoir, of say three feet diameter, should be placed athwart ship, on the top: it would also greatly simplify the boiler-mountings, and it would not interfere with the stowage of coal.

There is one objectionable feature which we would take leave to point out; namely, the length, 8 feet 1 inch, and the small diameter of the tubes, $1\frac{9}{16}$ through the ferrules. Until the blast-pipe is brought into play, the natural draft will be sluggish, and it will be a long time before *steam* can be *first* raised.

We can hardly see what can be gained by such a rigid adherence to the *style* of the locomotive boiler, especially where height is not of so much importance.

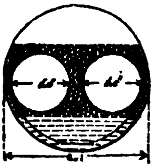


Fig. 3.

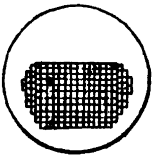


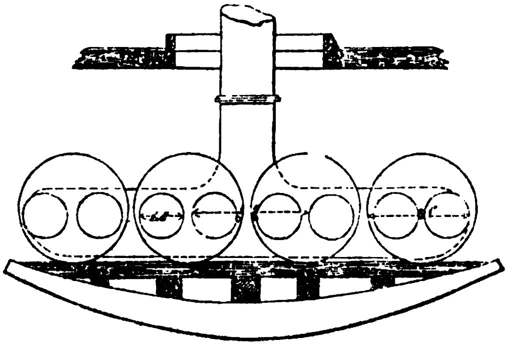
Fig. 4.

It is said that the *Malacca's* boiler (a sketch of which will be found in our January number), with tubes 6 feet long, gets steam very freely, and that there is also a good natural draft.

If the tubes of the *Pembroke* class had been $2\frac{1}{2}$ inches, and strong enough not to have required ferrules, and not longer than 6 feet, we can fancy that they would have been very successful and very useful marine boilers.

The exigencies of the war will not, we presume, afford time to enter into careful experiments with the machinery of these high-pressure steamships at present; but we will look forward with hopeful anticipation, and trust that the Steam Department will give publicity to the results, when obtained, in respect to the power developed in proportion to the coals consumed.

Fig. 5.—End elevation of Boilers.



The screws of the *Pembroke* class are overhung; and, contrary to the usual practice in the Royal Navy, there are no 'screw-wells for the purpose of raising the screw out of the water. The reason of this, we presume, is that *time* could not be allowed to make this change in the ship.

The outer bearings of these ships are lined with *lignum vitæ.* We shall watch this novelty with some anxiety.

The *Pembroke's* screw is 12 feet diameter, and 12 feet pitch.

For the Journal of the Franklin Institute.

Improved Friction Hammer. By James Kitson Leeds, Esq.

In the July number of the Journal, at page 35, a full description with engraving is given of the above hammer. I wish to inform the readers of the Journal that a hammer, identically the same, was patented in this country by Mr. George E. Sellers, of Cincinnati, in January, 1844, and that a hammer was built under the patent by the Novelty Works, in New York, for the Atlantic Forge of that city, and that after repeated trials, it was abandoned, and a Nasmyth steam hammer, built by Merrick & Sons, of this city, substituted in its place. B.

For the Journal of the Franklin Institute.

Champion's Improvements in Feeding and Circulating Water in Boilers, etc.

Under the above head, Mr. Champion, at page 43 of the July number of the Journal, uses the following language in relation to his improvements:—

"M M, are conduits for leading the products of combustion from the flues up the stack while the damper o is open, and the fire is kindling and steam is raising, but when steam is up, the damper and ash pit closed, and the engine running, then the exhaust forces all down the stack beneath the grate, and up through the fire round and round, saving and burning all the heat, smoke, gas, and exhaust steam."

Not being acquainted with such subjects, I wish to inquire if all Mr. Champion says can be true, if he can burn all the *heat*, *smoke*, *gas*, and *exhaust steam*, it appears to me that there is but little left for science to accomplish. The united steam power of this city requires, daily, the water of a small stream for its supply. If Mr. C. can burn this steam in the manner he says, does he not, literally, set the river on fire? X.

For the Journal of the Franklin Institute.

The Caloric Engine.

We learn that Captain Ericsson is still at work perfecting his improvements in this engine. A pair of engines are nearly completed at the establishment of Messrs. Birkbeck, Furman & Co., in New York. As soon as they are finished, we understand that it is the intention of Capt. E. to invite such engineers as have the confidence of the country, to make such tests as they may consider satisfactory, for the purpose of fully demonstrating the advantages or defects of the system which he has brought forward and advocated with so much zeal for the past few years.

Z.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, July 19th, 1855.

John C. Cresson, President, in the Chair.

Thomas Becherton, Recording Secretary, pro tem.

The minutes of the last meeting were read and approved.

Letters were received from the Imperial Royal Geological Society, in Vienna, and from Charles F. Loosey, Esq., of New York.

Donations to the Library were received from The Royal Astronomical Society; The Society of Arts, and the Statistical Society, London; The Royal Irish Academy, Dublin; The Imperial Royal Geological Society, Vienna, and from Mr. Theophilus P. Code, and Mr. Edward Smith.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for June was read.

The Board of Managers and Standing Committees reported their minutes.

The candidates for membership in the Institute, (2,) were proposed, and the candidates proposed at the last meeting, (7,) were duly elected.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on T. J. Weygandt's Galvanometer.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, an "Improvement in Galvanometers" invented by Mr. T. J. Weygandt, of Philadelphia, Pennsylvania—Report:

That they have carefully examined the galvanometer made by Mr. T. J. Weygandt for Professor Boyé, of the Philadelphia High School, and exhibited at the meeting of the 15th of March.

The principal novelty is in the construction of the pole changer, which gives great facility in working, and allows the coil and divided circle to be turned freely around without altering the position of the pole changer or disturbing the needle.

The instrument rests upon a flat circular wooden stand about 9 inches in diameter, which is supported on three levelling screws. On one side of the stand are the two binding screws for the reception of the wires from the thermo-pile or the metals to be experimented upon, the wires running from them to the keys of the pole changer, which is situated diametrically opposite to the binding screws on the stand.

From the centre of this stand rises the brass centre, upon which the circular glass box containing the coil and graduated circle turns with a very steady motion. The two needles are suspended by a human hair from a hook at the top of the instrument, which is arranged so as to be very nicely adjusted for the twist and for its height in the coil.

The coil, needles, and graduated circle are enclosed in a glass box, the plate on the top of which has a small hole in the centre, through which the suspending hair passes; the hair being protected by a glass tube, the top of which is supported by the long brass standards which carry the suspending hook. By this arrangement the graduated circle can be read through a plane flat glass instead of through the side of the glass cylinder as frequently constructed.

The inner wire of the coil comes down to a brass ring, which is fixed to the underside of the bottom of the revolving box. Concentric with this ring and in the same plane, at the distance of half an inch, is another brass ring, which is connected through the axis with the wire from the outside of the coil. These two rings thus form the extremities of the coil, and the pole changer plays between them. The wires from the binding screws are attached to two brass slips which terminate in pieces pressed by a spring against the inner ring, so that when the pieces are in their normal position, the current from the binding screws passes through the short space of ring between them and does not go through the coil, but when either of the pieces is withdrawn from the inside ring and pressed against the outside ring, the current passes through the coil, and by altering their position again, bringing that one which was against the inside ring in contact with the outside ring, and that which was in contact with the outside against the inside ring, the direction of the current is changed and the needle deflected in the opposite direction.

Now, if the stand is placed upon the table in a position which is convenient for the operator, with the keys of the pole changer near his left hand, the coil and graduated circle can be placed in any position without interfering with the circuit, as some part of the brass ring must always be opposite to the pole changer.

Each key of the pole changer works like the writing key of a telegraph, that is, it is depressed by the finger and returns to its position by the spring attached to it. By means of the fore finger and the second finger, depressing the keys alternately, the direction of the current can be changed six or eight times in a second, and the motion being in a vertical plane is little liable to affect the adjustment of the instrument. The operator has, therefore, very great facility in bringing the needle to rest by changing the circuit, and thus checking the vibrations, which enables him to make a great many more observations in a short space of time than with any other instrument known to the Committee.

Through the kindness of Professor Boyé, the Committee were enabled to make a few experiments with the instrument for the purpose of testing its delicacy.

Two pieces of zinc and bismuth, each about the size of an ordinary type, being held in the fingers of the operator, the free ends touching the binding screws, produced an instantaneous and steady deflexion of 175°.

With a small magnet weighing about half an ounce, a deflexion of 95° was produced at the moment of induction, by introducing the magnet into the coil.

Two wires of zinc and copper $\frac{1}{20}$th of an inch in diameter and dipped $\frac{1}{16}$th of an inch into a single drop of Schuylkill water, gave an instant deflexion of 12°.

With a small Melloni thermo-multiplier of 20 pairs, the heat from the face of one of the observers at a distance of eight feet gave a deflexion of 68°.

The needle can be brought to rest after a deflexion of 90° in a very few seconds by alternating the current by means of the pole changers.

The needles are remarkably astatic, having a very small directive power, and standing steadily in an east and west position, with a slight trouble in setting them. Mr. Weygandt mentions, that the power of the needles was balanced by rubbing the stronger one lightly upon an oil stone, which appeared to weaken without removing any sensible part of its weight.

Altogether, the instrument is very remarkable for its high finish, extreme delicacy, and great convenience in use, the arrangement of the pole changers enabling the observer to make many observations in a short time by the great ease in bringing the needle to rest, by changing the current rapidly.

By order of the Committee,

Wm. Hamilton, *Actuary.*

Philadelphia, June 14, 1855.

PALMER'S PATENT LEG.

This world renowned Artificial Limb. it will be recollected, was among the *few* signal triumphs of American ingenuity exhibited in the WORLD'S EXHIBITION in 1851. It there received the award of the GREAT PRIZE MEDAL, as the "*best*" limb (amongst thirty of the best English, French, and German manufacture) exhibited; and was so well appreciated, that an extensive manufactory is now in successful operation at 30 Regent Street, London, under the auspices of the Queen and the Medical Faculty of London and Paris.

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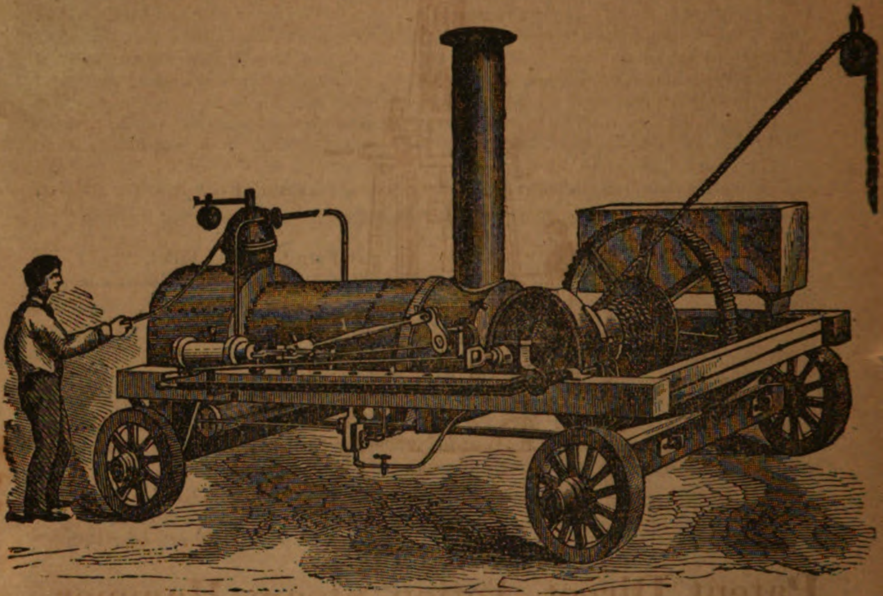
He continues to prepare and argue cases before the United States Patent Office, and obtain Patents in Foreign Countries, and Plans and Specifications for Machinery.

A connexion, official and otherwise, of more than sixteen years with the United States Patent Office, renders references superfluous.

A. L. ARCHAMBAULT'S
PORTABLE STEAM
HOISTING AND PUMPING ENGINE.



THE FRANKLIN INSTITUTE, at their Exhibitions in 1851 and 1853, awarded a First Premium (Silver Medal) for a PORTABLE STEAM HOISTING AND PUMPING ENGINE, for Loading and Discharging Cargoes, Pile Driving, Raising Iron Ore from Mines, Pumping Water, Driving Ore Washers, &c. Also arranged for driving Portable and Stationary Saw and Grist Mills; several are now in full operation. A First Premium and Diploma was also awarded by the PENN'A. STATE AGRICULTURAL SOCIETY, at their Exhibition at Philadelphia, 1854.

The Engine, which was exhibited at the Franklin Institute in 1851, was purchased by the Philadelphia Gas Company, and used for several months in raising water with elevators and hoisting. This engine having been superseded by another of increased power, in 1852, was afterwards purchased by the Schuylkill Navigation Company. Major Jones has had one in operation on his farm in Cecil County, Maryland, for some months, as a substitute for the horse-power formerly used by him in driving his threshing machine. Another was constructed by order of Pierce Butler, Esq., to be employed on the lands of the North American Coal Company. In 1853, a double cylinder Hoisting Engine was built for the Schuylkill Navigation Co. One for J. J. Holland, of Williston, S. C., with two 8-inch cylinders, for driving a Portable Saw Mill. One for the Philadelphia and Reading Railroad Co., with two 8-inch cylinders, for pumping. One for the Lebanon Furnaces, with two 6-inch cylinders, for hoisting coal and iron. One for the Dauphin and Susquehanna Railroad Co., with two 6-inch cylinders, for hoisting stone, &c., for bridge building. One for the Dauphin and Susquehanna Coal Co., for hoisting and pumping; and one for J. Sterrell & Co., Mifflin, Pa., for driving Barrel machinery.

This machine requires but one man to keep up steam and attend to the brakes. Pig iron can be discharged from a vessel at the rate of 25 tons per honr, and still faster if the hands can get it ready. If the weight while being raised should strike on the combings of the hatchway, the engineer has only to slacken the brake, and it is lowered (without stopping the engine) so as to clear the obstruction; then by drawing the lever connected with the friction brake, tight, the ascending motion is restored. The lowering brake is so arranged that the weight can be suspended at any point required.

References.—Prof. J. C. Cresson, Supt. Phila. Gas Works; Thos. I. Potts, Iron Merchant; Pierce Butler, Esq.; Rob. Kelton, 113 N. Water st.; H. Haupt, Chf. Eng. Penn'a. R. R. Co.; L. G. Mytinger; A. S. & W. L. Roberts, 80½ Walnut St.; Wm. Mahone, Chf. Eng., Norfolk & P. R. R. Co.; S. B. Sutton, St. George's, Del.; C. P. Morton, Mortonville, Chester County, Pa.; Sam'l. Entriken, Paoli, Pa.; Richard Hecksher, Minersville, Pa.; J. Dutton Steel, Esq., Civil Eng. Phila. & Reading R. R. Co.; R. B. Osborn, Chf. Eng. Dauphin & Susq. R. R. Co.; F. Fraley, Pres. Sch. Nav'n Co.; S. A. & W. Henderson, Norristown; Spencer & Mason, Pottsville; G. D. Coleman, Lebanon, Penn.; J. J. Holland, Williston, S. C; Maj. John Jones, Md.

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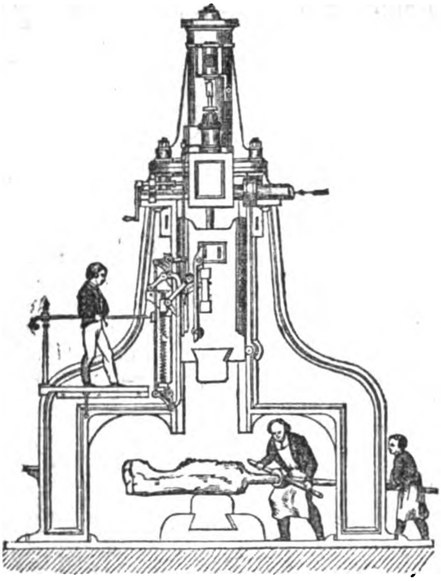

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The advantages of this Hammer over all other forms are as follows:—

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2d, The intensity of the blow may be modified instantly by the attendant, so as to suit the work; and the Ram may in like manner be *arrested in its descent* at any point, so that it is more completely under control than any other form known.

3d, It may be adapted to any description of work, whether for hammering blooms, making heavy forgings, or the ordinary light forgings for machine shops; for beating copper, or crushing stone, &c., &c., The form of the side frames can be altered to suit circumstances, so as to allow free access on all sides.

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OF THE
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FOR THE PROMOTION OF THE MECHANIC ARTS.

DEVOTED TO
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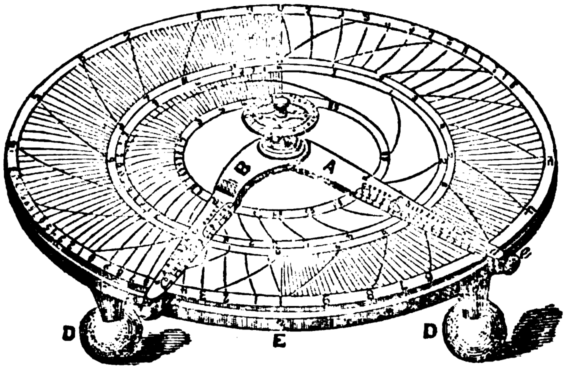

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FOR THE

PROMOTION OF THE MECHANIC ARTS.

SEPTEMBER, 1855.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

On a System of Telephonic Signals for Avoiding Collisions at Sea. Communicated by Charles H. Haswell, C. and M. E.

Having received and considered the communications of Professor D. H. Mahan, of the U. S. Military Academy, and of Lieut. W. T. Bartlett, U. S. N., regarding precautionary measures to be observed by steamers at sea, when running in an obscured atmosphere; I have to present to your notice the following reply thereto, together with my own views as to the precautions to be observed in such cases:

In the communication of Professor Mahan, it is proposed to resort to the use of blasts from a steam whistle in systematic connexion with the vibrations of a gong, which being interpreted by reference to a key in possession of navigators, the position and course of a steamer may be readily ascertained; and in that of Lieut. Bartlett, the same end is proposed to be attained by blasts from a steam whistle, peculiar to each of the cardinal points of the compass.

Both of these systems are practicable, but objectionable in some of their features, and for the following reasons:

1st. That of Professor Mahan is unnecessarily complicated by the introduction of a gong, and the interval between the signals is so short, as to render attention to them unceasing, whilst the frequent occurrence of them would be more objectionable of endurance to passengers and crew than the risk of collision.

2d. That of Lieut. Bartlett is the least objectionable of the two, but alike to the first named, the time between the signals is too short and the number of the blasts unnecessarily extended, and therefore liable to induce confusion and consequent error.

A reference to the facts of the late loss of the U. S. mail steamer *Arctic*, to the existing elements of precaution and necessity for it, to guard against like occurrences, presents the following details:

1st. The end desired to be attained is the increased security of lives and of property from the collision of steamers with each other and with sailing vessels.

2d. The only practicable method that suggests itself is, that of the navigators of steam vessels to avail themselves of the very effective means of a steam whistle, an instrument with which nearly all of our steamers are now supplied, and where it is not in use, the cost involved in its purchase and attachment is so inconsiderable, its utility considered, that it cannot present any objectionable feature to its adoption: and with sailing vessels, when such an instrument is not available, the watch bell can be resorted to.

3d. Signals are only necessary to guard navigators from the collision of their vessels, one with another, within the space of half a mile.

4th. The highest speed yet attained by steamers and sailing vessels at sea, or likely to be attained by them, *in an obscured atmosphere*, within many years, would not justify any assumption of a higher combined velocity to two vessels approaching each other upon opposite courses, than that of thirty-six miles (knots) per hour; a half of a mile, therefore, would be made by them in the space of fifty seconds; and when the speed was altogether upon the part of one vessel, as in the cases of the sailing vessel being becalmed, or the steamer crippled or disabled, the speed would not exceed twenty miles, and the time consumed then in running half a mile would be one minute and a half.

5th. The board of supervising inspectors of steam vessels, appointed under the act of Congress of 30th August, 1852, have ordered, that the pilots of all steam vessels navigating seas, gulfs, bays, lakes, or rivers, of the United States, when their vessels are running in a fog, "shall cause a bell to be struck, or the steam whistle to be sounded, every two minutes." No provisions are here required from navigators as a precaution from collision when their vessels are at anchor, and a critical construction of the regulation might, with those who were indisposed to practice the precaution required, furnish a justification for noncompliance with it, when the atmosphere was obscured by snow, rain, or mist. Further, the regulation is confined to the maritime jurisdiction of the United States.

6th. The variations of time on board of all vessels, would have the effect, in an average of cases, of reducing the intervals between the sounding of signals one-half.

With these elements before me, then, I present the following regulations to be observed by navigators of steam and sailing vessels, during the existence of an obscured atmosphere:

1st. All steam and sailing vessels to be provided with watch bells, and all steamers to be further fitted with a steam whistle of sufficient capacity to be heard in calm weather, five miles.

2d. Navigators of steamers and sailing vessels, without the maritime jurisdiction of the United States, when running, lying to, or at anchor; to give one full stroke of their bell or blast from their steam whistle, as they may be provided and prepared to, every five minutes, and when they shall hear either of these signals from another vessel, they shall immediately telephone their course or position after the following rules:

When running or heading between north-west and north-east, with one stroke of their bell or one blast upon their steam whistle, or when running as above between north-east and south-east, with two distinct strokes or blasts, and when between south-east and south-west, with three distinct strokes or blasts, and when between south-west and north-west, with four distinct strokes or blasts, and they shall continue their signals every two and one-half minutes, until they shall have passed beyond the risk of collision with each other.

3d. Navigators of steamers and sailing vessels, when entering into a harbor, are to give two continuous strokes of their watch bell, or blasts from the steam whistle, every five minutes.

4th. When navigators of steamers and sailing vessels have entered into a harbor, they are to conform to the maritime regulations of it, and where it is known that none exist they are to be guided by the existing regulations of the United States as here given.

5th. When it may be necessary in the opinion of any one or both of the navigators, of two vessels approaching each other, to know the courses of each other, nearer than that provided for as above; as in the case of a vessel running upon an extreme of the range of eight points embraced in a signal, and another either upon the other extreme of the range of the same signal or upon the near extreme of the range of the signal contiguous to it; the navigator who desires to know the course of the vessel approaching him, to give his course as above directed, and immediately thereafter should give the signal of the course in the range nearest to his, in short and rapid strokes of his bell or blasts from his whistle as he may be provided to do, and the other is to reply in like manner and to give the course in the range nearest to his. Thus, if the course of a steamer was between east and south-east, the signal would be two distinct strokes or blasts, and immediately thereafter three rapid strokes or blasts, signifying that her course, although within the range of N. E. and S. E., approached to that of S. E.

The utility of this system over that of one where the course of a vessel is being constantly indicated, is, that it reduces the number of signals and thereby removes from it the objectionable features of unnecessary labor, to those in charge of the duty, and of unnecessary disturbance to the passengers and crew, whilst it retains the whole of the essential feature, that of the indication of the courses of vessels in proximity with each other.

In the operation of this system however, full success is neither claimed or anticipated; neither is it conceded to any system depending alone upon telephonic signals, for in order to meet some cases of which the following are fair instances, a light, of sufficient power to reflect its rays in a fog or mist, at a distance of a quarter of a mile, must be resorted to and placed upon the bows of all vessels.

The instances alluded to, or such as would seem to render the precaution of even a steam whistle inoperative, are:—

1st. When a sailing vessel is "lying to" in heavy thick weather, and a steamer approaches her on the course of her lee beam, the watch of the sailing vessel may be unable either to see or hear the steamer until she is too close upon them to be avoided, in the inert condition of "lying to," and the watch of the steamer unable either to see the sailing vessel, or to hear her watch bell (it being of the usual size carried in vessels), they cannot discover their proximity to another vessel, until it is too late at their rate of speed to avoid collision, they only under the immediate command of the helm.

2d. The times of two vessels being alike, their signals may be given identical in time and duration, and if approaching each other at a high velocity, collision would be difficult of avoidance.

3d. The steam whistle of a steamer may become temporarily inoperative from a fracture of its pipe or other causes, and the watches of one or both vessels may neglect a signal.

I am of the opinion, therefore, that no system of signals adapted to an obscured atmosphere at sea can be always reliable, without the introduction of a light of great power, placed so as to be seen only from ahead of the vessel carrying it, and in connexion with this view of the requirements of navigation, I am gratified at being able to advise you that a light designed to meet this purpose, has just been brought to my notice, and that it is one holding forth much promise of its practicability.

I am, respectfully, your obedient servant,

Charles H. Haswell.

To Walter R. Jones, Esq.,
President Board of Underwriters, New York.

New York, October 30th, 1854.

For the Journal of the Franklin Institute.

On Errors Committed by Writers on Mechanical Engineering.

By William Truran, Esq.

The March number of the *Journal of the Franklin Institute*, (Vol. xxix, p. 145,) contains an article on errors committed by Writers on Mechanical Engineering. The subject being a refutation of the assumed gain of power attending a certain disposition of the handles of a windlass or other similar machine, actuated by manual labor, written after a lengthy practical experience on the matter, and, therefore, entitled to a favorable consideration from theoretical writers. In it, mention was made of an error committed by the late editor of the *London Mechanics' Magazine*, in stating that "the force of two men rightly applied to a crank, is more than twice one in the proportion of 70 to 60." This remark has called forth a reply from the present editor, Mr. R. A. Brooman, so thoroughly at variance with its professed object, that we have to request permission to answer a few of his allegations.

Mr. Brooman considers it necessary, to correct our version of Desagulier's erroneous assertion in these words, "what he states is, that if one man working at one handle of a windlass can raise 30 pounds *with a certain degree of ease*,* then two men working with handles at right angles, can raise 70 pounds *with a greater degree of ease.*" Now, the plain interpretation of this is, if one man with a given amount of exertion and fatigue can raise 30 pounds, two men with handles at right angles, each of them applying a similar amount of exertion, can raise considerably more than 70 pounds. Mr. Brooman seems to have some doubts as to its absolute correctness, for he states, "we do not at this moment purpose to contend that this somewhat loose statement is true," although the reader will perceive that its truth, or otherwise, is the sole matter in dispute, and one which in common fairness he ought to have settled; but instead of so doing, he endeavors to prove by our statements, that "since the force exerted by a man at the handle of a windlass is constantly varying, it is clear that the greatest weight which he can raise, is determined by the minimum force." So far correct; but foreseeing that it would destroy his case, Mr. B. considers it advisable to say nothing as to the relative position of the second man with handles at right angles to the first, merely assuming that he is then exerting a maximum force. It is on this point that the whole matter hinges. We have shown by a diagram, that in disposing the handles at right angles, the two men simultaneously arrive at the portion of the revolution wherein they have the least ability to exert a maximum force, and further, in support of our position, we adduced the known fact (one which Mr. Brooman can hardly be ignorant of) that in practice, workmen left to their own discretion invariably set the handles of windlasses diametrically opposite to each other.

The arguments advanced by Mr. Brooman in support of his untenable position, are as far-fetched as ridiculous. "We recommend Mr. Truran to furnish himself with a friend of equal strength with himself, and a windlass or crane with a very long handle, so that he shall be thrown into inconvenient postures in turning it, and be able to exert but a small force in some positions—say when the handle is moving through the upper arc of its path, at such a height above his head that he can but just grasp it." Where, we would ask, is the windlass or crane with handles at any portion of the revolution high above the heads of the men working them? And further, we would ask, what force can a man exert with the handle in the unheard-of position that Mr. Brooman finds it convenient to place it. This argument of Mr. B.'s is a most unfortunate one, and shows his utter inability to deal fairly with the matter.

Continuing in the same spirit, his remarks, Mr. Brooman says, "allowing for the laxity, which even editors sometimes exhibit in private correspondence, the statement of our predecessor is undoubtedly true, although it would have been better had he avoided the mention of a given proportion." Thus in the same breath it is asserted, that there is a positive gain by disposing the handles of a windlass at right angles, but it is not advisable to state the amount of such gain (we presume lest it might be incorrect); altogether a curious way of corroborating a statement that requires some tangible facts for its support. Is the gain of such an ephemeral character that it can neither be measured nor calculated? The

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* The Italics are in the original of Mr. Brooman.

London Mechanics' Magazine is profuse in its mathematical demonstrations. Here was a fit subject for displaying its abilities, but for the best of all reasons, that no mathematical investigation would avail, the opportunity was not embraced.

What is meant by the "laxity, which even editors sometimes exhibit in private correspondence?" Is it that Mr. Brooman in his capacity of civil engineer would be justified in giving an erroneous opinion to a client who paid him handsomely for it, but in his editorial capacity would not be justified in publishing to the world a similar inaccurate statement? To us it looks very like an admission that his predecessor was a little in error, which he is most anxious to excuse.

In order farther to strengthen his position as an advocate for the gain of power when the cranks are disposed at right angles, Mr. Brooman takes the liberty of perverting our remarks to suit his peculiar views. He says that the statement of his predecessor was to the effect "that from two men rightly applied, a greater result may be obtained than from the same two wrongly applied."

Now, the extract we gave from Mr. Robertson's letter, was copied literally, and nowhere contains the saving clause "wrongly" which Mr. Brooman wishes to introduce, nor was it intended to be thus qualified, for in subsequent letters, the gain of power is steadfastly adhered to. It will be recollected that the purport of our remarks, was not whether the strength of men was rightly or wrongly applied when applied to windlasses, but to contradict the oft repeated assertion that by disposing the handles at right angles there was a gain of power—by which is understood the ability to raise a heavier weight with the same degree of exertion; and further, they were intended to apply to windlasses as usually constructed, not to exceptional modifications never met with in practice; therefore, Mr. Brooman's line of defence is altogether wide of the question.

Mr. Brooman's advice to the writer to obtain correct ideas on the matter "by applying to any of those obliging and communicative individuals who, either in America or in this country, devote their energies to the elevation of bales, the dredging of mud, or any similar occupation," is on a par with the other portions of his reply, and however witty he may consider this remark of his, the reader will perceive that it is strangely at variance with the respectability he claims for his *Magazine*, and the solicitude which he manifests for the character of the *Journal of the Franklin Institute.*

July 10*th*, 1855.

Durability of Railroad Iron.[*]

The complaints respecting the inferior quality of recently manufactured rails, naturally attributable to the attempts made by companies to reduce the price, have attracted attention both in this country and in the United States, and have led to some practical and scientific inquiries. On the first introduction of railroads, it was confidently asserted by their promoters, that the rails would last for indefinite periods, but experience soon demonstrated that railway bars were subject to lamination and disintegration, from the repeated rolling of heavy loads. Their duration, in some instances, has not exceeded two or three years; and in some of the earliest constructed lines in England, the rails have been changed twice, or even three times, since their opening. Opportunities have, accordingly, presented themselves to the engineers on these lines, of ascertaining the actual powers of endurance of iron rails, and of calculating the amount and extent of traffic which they are capable of withstanding under the varied circumstances to which they are exposed. Where the conditions are favorable, and the bars themselves perfectly sound, it is believed that the traffic which rails of ordinary quality are capable of bearing will not fall very short of 20,000,000 tons. The rails laid down on many of our railways have not, however, carried one-fourth of this traffic; and large quantities have been, in some instances, renewed which have not borne a tenth of that weight. Well recorded obervations on this subject are much to be desired, and would prove of the greatest benefit, not only to railroad companies and their shareholders, but also to engineers, and even to the iron trade in general. In directing attention to the subject, we need not remind the public that this Journal is at the service of those who are enabled to furnish scientific or practical information in reference to it.

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[*] From the London Mining Journal, No. 1027.

A paper has appeared in a recent number of the *Journal of the Franklin Institute*, of Pennsylvania, " On the Durability of Railroad Iron," by Mr. William Truran, in which the question has been partially discussed, and some details supplied respecting the wear and tear of rails on some railways. Much of the information thus collected has from time to time appeared in the columns of this Journal, and although of value in a concentrated form, cannot be new to the scientific or practical English engineer. It is observable, however, that the paper is confined to some local lines, and does not refer to the great trunk railways of this country. They are, of course, the lines from which general deductions can be most safely derived, and in which the most perfect means exist of recording full and accurate information. Mr. Truran has drawn certain conclusions from the limited examples which he has been enabled to give, of the duration of railway rails under different conditions of laying and working, and he remarks, that in every instance where, in the construction of the permanent way, solidity had not been obtained by the employment of adequate sleepers, the destruction of rails had been most rapid. The greater duration, on the other hand, may be attributed to the use of heavy rails, to the wagons and carriages having bearing springs, and to a well constructed and carefully maintained permanent way. Favorable instances of durability have been found to arise from favorable grades, but the absence of bearing-springs has been found to have a prejudicial effect on rails, and to have greatly lessened their duration. When the quality of the metal used has been inferior, and the nature of the fastening employed defective, unfavorable results might be naturally expected. It has, we are informed, been found in practice that the cost of labor and materials, in supplying and replacing unsound bars, and the ultimate expenses incidental to the entire renewal of the rails, of course irrespective of their first cost, is generally equivalent to the value of the old metal obtained. It is obvious that this investigation opens a field of curious and interesting inquiry, and our specially directing attention to it may, perhaps, lead to more perfect arrangements for the collection of future materials.

Every advance in the manufacture of rails is a matter of national importance, and we feel proud to acknowledge that Wales is taking the lead in practical improvement. The heaviest rail ever made has been manufactured at the Rhymney Works, Monmouthshire—a Barlow rail, 52 feet 6 inches in length, 90 lbs. to the yard, being a total weight of 1575 lbs. The longest rail ever made, a double-headed rail, 60 feet long, 75 lbs. to the yard, total weight 1500 lbs. has just been manufactured at Tredegar Works, also in Monmouthshire. It is difficult to decide which ought to bear the palm, the Rhymney rail being $\frac{1}{20}$th heavier than the Tredegar rail, and the Tredegar rail being $\frac{1}{7}$th longer than the Rhymney rail; but it must be remembered that a double-headed rail is more difficult to be manufactured than a Barlow rail. The reduction of duty on rails imported from this country into France, while illustrating the enlightened policy of the French Emperor, has given fresh impetus to the manufacture in England; and we believe this country is likely still to maintain her superiority. We cannot conclude without recording the public spirit evinced by the workmen at Tredegar, who, having finished their week's work (about 700 tons of rails), on learning that it was contemplated to make a long rail, volunteered, without remuneration, to manufacture the longest rail in the world. The rail was accordingly wrought, and heated in one of the ordinary furnaces, and, after a week's toil, was finished by the gratuitous labor of the workmen, whose independence thus sought to maintain the pre-eminence of their country.

*Ship Canal across the Isthmus of Suez.**

M. de Lesseps is now on his return from Egypt to Paris, probably to make the necessary arrangements for carrying out the project with which he has been so long occupied, and for which, it is believed, he has at last obtained the consent of the Ottoman Porte, that of the Viceroy of Egypt having been long ago and very readily given. This project is the important one of cutting a ship canal through the Isthmus of Suez, and thus making an expeditious and easy direct passage for ships of large size from the Mediterranean into the Indian Seas. The line originally traced out for this canal was from Tineh to Suez, the narrowest point of the Isthmus; but this, from a congregation of difficulties not then sufficiently studied, and from data and calculations erroneously founded, it was deemed necessary to abandon; the more so as the cost could not be less than 300 millions of francs, whereas that for the canal of greater length now proposed is estimated at no more than 240 millions. The establishment of a canal at the narrowest part of the Isthmus is besides surrounded with such difficulties of execution that the authors of the project now approved of by the Pacha of Egypt, have decided in preference of the line by Alexandria and Cairo. The port of Alexandria and the roadstead of Aboukir are exempt from the obstacles to navigation which the Nile creates north-east of the Delta. A current running along shore from west to east carries away from Alexandria the mud brought down by the river, and keeps the waters of this part of Egypt clear and deep. By opening the canal at Alexandria the enterprise is saved the considerable and costly works necessary at Tineh. Canals of communication between the Mediterranean and Indian seas not only existed from the most distant period, but vestiges of them are still found, agreeing with the plan now proposed. There was, however, a very important difference between the ancient canal and that now in question; which is, that the first was almost exclusively devoted to internal navigation, and probably had but little depth of water. The present dimensions of the English ships trading between India and Europe, oblige the engineers to enlarge the proportions of the projected canal. It is proposed to admit of the passage of large ships of war, and to maintain the necessary depth of water. The difficulty does not consist in the works to be executed for constructing the canal and locks, and for finishing all the other requisites, but in finding the means for feeding the canal to a depth for large ships. After extended surveys it has been found that the water supply cannot so readily be procured from the two seas as had been conceived, and that recourse can be more easily and conveniently had to the waters of the Nile, for that river has been ascertained, contrary to former belief, to have an elevation considerably above that of the sea.

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*From the Lond. Civ. Eng. and Arch's. Jour. July, 1855.

AMERICAN PATENTS.

List of American Patents which issued from July 10, *to July* 31, 1855, (*inclusive,*) *with Exemplifications.*

JULY 10.

51. For an *Improvement in Apparatus for Draining Sugar;* John Aspinal, London, England.

Claim.—"The combination of the porous carrier conveying a thin layer of the sugar to be drained with the exhausted chamber, having apertures covered by the carrier, whereby the said sugar is exposed to atmospheric pressure while passing said apertures."

52. For an *Improvement in Ventilating Railroad Cars;* Charles Atwood, Birmingham, Connecticut.

Claim.—"The method of constructing, attaching, and using the flexible connexions. Also, the combination of the flexible connexions with any suitable method of receiving the air at the front end of the tender."

53. For an *Improved Method of Raising and Lowering the Cutters of Harvesters;* Jonathan F. Barrett, North Granville, New York.

Claim.—"Connecting the front of the frame with a lever for effecting the elevation of the cutters, for the passage of obstacles by the drivers' foot."

54. For an *Improvement in Processes for Treating Wool;* Thomas Barrows, Dedham, Massachusetts.

Claim.—"The application of nitre, or any of its equivalent salts, to wool in a warm bath, for the purpose of restoring wool when it has become changed, as well as for cleansing, softening, and preparing it, so as to better adapt it to receive dyes and being finished in fabrics."

55. For an *Automatic Machine for Turning Ship Spars, &c.;* William Blackburn, Jersey City, New Jersey.

Claim.—"1st, The combination and arrangement of the gears, x x and *d*, with the self-adjusting rests, or mechanism substantially the same, for holding the stick, whether straight or tapering, always firm and steady during the operation of turning. 2d, The combination of the chisel-holder, screw, and gear *d*, (or mechanism equivalent thereto,) for working the chisel-holder simultaneously with the self-adjusting rests."

56. For an *Improvement in Air and Steam Engines;* Francis Brown Blanchard, Waterville, Maine.

Claim.—"As arranged with the boiler and stack of tubes, or their equivalents, the two chambers, and their respective connexion pipes, such chambers, pipes, and stack of tubes being used for the purpose of regulating the temperature of the mixture of steam and gases. Also, in combination with the air pump and the furnace, the tubular air condenser, for the purpose of reducing the heat of the condensed air and relieving the air pump from back pressure. Also, combining with the coal feeder the distributing valve. Also, arranging hollow grates on an angle in combination with arranging them with and directly under a full supplying tube or hopper, so that the fuel dropped out of the latter and upon the inclined grates may be distributed by them."

57. For an *Improvement in Gas Regulators;* Saml. W. Brown, Lowell, Mass.

Claim.—"The lever, and valve, and knife edged guides or points of support, for sustaining and guiding the lever and valve, and the float, which are so arranged and operated by the pressure of gas within the float, as to apply great force to open the regulating valve, to overcome the sticking or adhesion of this valve to the top of the induction tube by the gas tar, and then to continue to open or close it in proportion to the number of lights which are being regulated, and the pressure of the gas through the induction tube, so as to regulate the burners nicely and evenly."

58. For an *Improvement in Lubricating Compounds;* Eleazar Brown, Jr., Binghamton, New York.

Claim.—"The use and application of saltpetre combined with common hard soap and fat salt pork, or any similar oleaginous animal substance, thereby forming an antifrictional refrigerating lubricating compound, adapted to the purpose of lubricating the journals of railroad cars, locomotive engines, and, also, the journals of all kinds of machinery."

59. For an *Improved Sun Shade;* S. N. Campbell, Elgin, Illinois.

Claim.—"Attaching a frame formed by the rods to a head band or to a cap, said frame being covered with any proper material."

60. For an *Improvement in Saddle Trees;* Daniel Campbell, Washington, D. C.

Claim.—"The combination of the side bars to the pommel and cantel by means of the springs."

61. For a *Device to allow Escape of Waste Water from Pump Barrels;* Jas. E. Crouk, Poughkeepsie, New York.

Claim.—"The valve placed over the outlet passages leading from the chambers, said valve being attached to a spring lever, E, which is acted upon by a sliding rod, so that said valve will be closed by merely grasping the handles of the sliding rod and lever, D, in operating the pump. The valve being opened when the handles are freed from the hand by the action of the spring, J."

62. For an *Improvement in Straw Cutters;* Lyman Clinton, North Haven, Conn.

Claim.—"Placing knives or cutters on the wings of two revolving arbors or shafts, when the edges of said wings have rebates cut in them, so as to form lips or ledges opposite the cutting edges of the knives or cutters."

63. For an *Improvement in Spark Arresters;* Daniel Deshon, 2d, Whitestown, N. Y.

Claim.—"The arrangement of the deflector at the base of the pipe, the curved flanch at the top, and the gauze or grating at the side."

64. For an *Improvement in Looms;* Rufus M. Dill, Holyoke, Massachusetts.

Claim.—"A sliding bar attached to the lay, having projections adapted to each shuttle of a series at its outer end, and actuated from the inner end by a groove attached to the frame of the loom."

65. For an *Improvement in Buckles;* Sheldon S. Hartshorn, Orange, Connecticut.

Claim.—"The manufacture of buckles composed of but two pieces."

66. For an *Improved Ship Pump;* John J. Heard, Boston, Massachusetts.

"The nature of the invention consists in an attachment to the ordinary pump, by which means it may be made to operate either upon the water in the well, or upon that in the bilge."

Claim.—"The attachment with its gate."

67. For an *Improvement in Fastenings for Carpets;* Enoch Jackman and Edwin G. Dunham, Portland, Maine.

Claim.—"The method of securing carpets to floors by the arrangement and application of a socket and pin, or a plate and pin so applied, that the friction which is caused by the contraction of the carpet, in canting the pin in the socket, may prevent the pin from slipping out of the socket, so that carpets may be put down and taken up at pleasure with nothing but the hand."

68. For an *Improvement in Slide Wrenches;* Benj. F. Joslyn, Worcester, Mass.

Claim.—"The nut surrounding both parts of the jaws and long enough to give the required motion, with a thread on its inside working in the edge of part B, the part A surrounding the part B with the slot, and the part B sliding in the part A, with a thread on its projecting edge to receive the nut."

69. For an *Improvement in Washing Machines;* Wright Lancaster, Harmony Township, Indiana.

Claim.—"The floating rods, claimed to be an improvement on any former machine, for their freedom of action, their adaptation to the washing and cleansing of cloths by friction, without damage to the finest fabric, and the facility and speed with which this process is performed."

70. For an *Improvement in Steam Boilers;* James Murphy, City of New York.

Claim.—"The combination beads, or their equivalents, on the tubes, grooving the surface of the tube sheets around or partly around the tube holes to receive the metal of the tube when riveted, by means of which, I am enabled more effectually to secure tight and strong joints than by any other known method."

71. For an *Improvement in Machines for Pulverizing Clay;* John O'Neil, Kingston, New York.

Claim.—"The combination of the spring blades with the ridged surface of the cylinder against which they act. Also, the combination of the aperture in the depressed part of one or more of the ridges with the spring blades, which eject or force out the stones. Also, the combination of the cutting or pulverizing blades with the ridged surface of the cylinder. Also, the perforated or grated door and slide, for the purpose of regulating the discharge of tempered clay."

72. For an *Improved Machine for Cutting Screws on Bedsteads;* Orson Parkhurst and Daniel Bullock, Cohoes, New York.

Claim.—"Arranging and operating the rotary cutters at an angle, so that we can traverse them parallel to the rail and cut under the concave shoulder."

73. For an *Improvement in Harvesters;* Isaac Irvine Hite, Assignor to Washington F. Pagett, White Post, Virginia.

Claim.—"The combination of a raker's seat or stand with McCormick's machine for cutting grain and gathering it upon a platform."

74. For an *Improvement in Saw-Sets;* F. A. Parker, Shaftsbury, Vermont.

Claim.—"The arrangement of the circular spring, the adjustable bar, and the connecting rods."

75. For an *Improvement in Attaching Cast Point to Steel Mould Boards of Ploughs;* Adonijah Peacock and Simeon Peacock, Cincinnati, Ohio.

"We claim nothing new in the form of the solid cast metal point which we use, except the recess or shoulder at B C, fig. 1, for the purpose of attaching the steel part of the mould board to the cast point. Or in the steel mould board which we use, except cutting the point off at B C, fig. 2, which is generally done at a distance of from six to eight inches from A, fig. 1, for the purpose of attaching to the cast point at B C."

Claim.—"The use of a solid cast metal point in connexion with steel or other wrought metal mould boards for ploughs, when united therewith, as described, or in any way equivalent thereto, so as to form of the two parts a mould board, the greater part of whose surface is steel or other wrought metal, and the point or front part of solid cast metal as a wearing point."

76. For an *Improvement in Rope and Cordage Machines;* Saml. Pearson, Jr., and Wm. H. Gardner, Roxbury, Massachusetts.

Claim.—"Arranging two or more twisting fliers, or two or more series of the same, with the twisting axes of revolution of one of them in line with the others respectively, and combining with each two fliers in line, hollow tubular necks (for the reception and support of yarn or strands from the bobbin), and a contrivance or contrivances for either uniting or disconnecting such necks, so that the fliers of several series thereof may be rotated together, or seperately, in order that when small sizes of rope are to be made, only one twisting flier or series may be put in operation, and when larger sizes of rope are to be manufactured, two or more twisting fliers or series thereof, may be combined and put in action together and with one laying flier. And, also, the rope or strap and its weight (or the equivalent thereof,) in combination with the conical laying tops, and the bearing plate."

77. For an *Improved Stave Machine;* Wm. Robinson, Augusta, Georgia.

Claim.—"The horizontally slotted spring knife holders combined with the guides, on the driver, so as to prevent the longitudinal movement of said holders during the driving operation, and cause the knife, at the completion of the cut, to force the stave into the lower bed and there hold it during the return stroke of the driver."

78. For an *Improved Vibrating Stop-Water for Ships and other Vessels;* Stephen Saunders, South Kingston, Rhode Island.

Claim.—"The combination of vibrating water stops with the hulls of vessels."

79. For an *Improvement in Counter Scales;* Fredk. Scheurer, City of New York.

Claim.—"The combination of two common beam scales with their inner arms connected together by links, to which the scale to receive the weights is attached, and their outer arms being connected by a frame to carry a float or straight scale to place the goods on, which are to be weighed."

80. For an *Improved Self-Regulating Water Packing for Pumps, &c.;* Joseph Smart, Philadelphia, Pennsylvania.

Claim.—"The application to pump caps of two stuffing boxes, so arranged one above the other, leaving a space or reservoir between them. Also, the manner of supplying the same with water by means of a small valve on the lower plate, or any other substantially the same, which will produce the intended effect."

81. For an *Improvement in Excavators;* Saml. W. Soule, Oswego, New York.

Claim.—"The frame placed on the crank of the axle or shaft, said frame being provided with buckets, one at each end, and enclosed by a box provided with transverse pins or rods."

82. For an *Improvement in Railroad Draw-Bridge Signals;* Simeon L. Shafford, deceased, late of Philadelphia, Pennsylvania.

Claim.—"The combination of the sliding signal frame, the signal boards, the signal lantern, and the signal lever. Also, the combination of the sliding signal frame, the signal boards, the signal lever, and the stop lock. Also, the combination of the latch lever, the signal lever, and the sliding plate."

83. For a *Machine for Cutting Legs for Pianos, Tables, &c.;* Andrew Stoeckel, City of New York.

Claim.—"The arrangement of the carriage with the vibrating frame attached, cutter disk, and cutters on the shaft and drum, placed in the swinging frame."

84. For an *Improved Gauge for Stair-Rails;* Chs. M. Swany, Richmond, Indiana.

Claim.—"The combination of the yielding or movable gauge and adjustable spring pencils."

85. For an *Improvement in Means for Increasing Draft in Locomotives;* Charles F. Thomas, Taunton, Massachusetts.

Claim.—"Combining with an air receiving mouth (arranged on the front end of the locomotive steam carriage) the chimney and smoke box, a secondary chimney and a concentric or surrounding air passage, whereby, when the steam carriage is in movement on the railway, a current of air may be caused to rush into the chimney and around above the mouth of the secondary chimney, and so as to aid in increasing the draft through the smoke tubes. And, also, in combination with the air deflector, the air passage, one or more closing valves or doors to the former, a covered deflector, and one or more other mouths or openings, and a closing contrivance or annular valve, v, the same being so applied as to enable the engine, either in moving forwards or backwards, to cause a current of air to enter its chimney. Also, the manner in which the valve c is made and applied to the passage, and the secondary chimney, in order that it may not only serve to diminish the discharging mouth of said passage, but deflect or contract the tubular current of air passing out of it, and so as to improve the draft of the same."

86. For an *Improvement in Brick Presses;* Stephen Ustick, Philadelphia, Pa.

Claim.—"1st, Combining the inner and outer peripheries of the rim of the revolving casting, shaped in segmental curves, eccentric with each other and with the centre of the shaft on which the casting is secured, in such relation to the upper and lower pistons for pressing the brick frames to which they are attached, and the friction wheels in said frames, as to cause the said segmental surfaces to operate on the friction wheels in their revolutions between the same, after the manner of a wedge, and thus avoid all liability of strain on the shaft, arising from the resistance of the pressure exerted in pressing the bricks by confining it to the body of metal between the two surfaces. 2d, Forming the faces of the pistons of longitudinal and transverse plates secured to the blocks or main body of the pistons by dove-tailed tongues or grooves, and wedges or gibs, and capable of being moved outward sideways and endways, so as to increase the area of the face of the pistons in case of wear. 3d, Forming a narrow slit in the centre or other part of the face of the piston, widening as it extends from the face, or not, as desired, and communicating with the outside of the pistons through their ends for allowing the air confined in the moulds to escape during the pressing of the clay into bricks."

87. For an *Improvement in Open Stirrups;* Orrin D. Vosmus, Mt. Sterling, Ky.

Claim.—"In combination with an open stirrup, a shank piece or arm, which passes between the stirrup straps and is held in place by a loop, or its equivalent."

88. For an *Improvement in Machines for Making Bolts;* Wm. E. Ward, Port Chester, New York.

Claim.—"The mode of operation for drawing or rolling to a cylindrical shape the end of the stem of square bolts, by means of the segment rollers in combination with the jaws, or equivalent therefor, on the sliding and rotating mandrel operated by an arrangement of mechanism, (as described,) or any equivalent therefor. Also, the mode of operation for taking the bolts from the feeding ways, or any equivalent device by which they may be supplied, and bring them to a horizontal or nearly horizontal position, by means of a vibrating wing which enters back of the bolt to be separated, and then vibrates to bring it to a horizontal or nearly horizontal position, in combination with the transferring pincers, or any equivalent therefor, by which they are transferred to the jaws, the required motion being imparted by an arrangement of mechanism (as described) or any equivalent therefor."

89. For an *Improvement in Sewing Machines;* James B. Woodruff, Washington, D. C.

Claim.—"1st, The arrangement of the needle shuttle and feeding arms, the connecting rods and pulley, with its wrist. 2d. Giving to the needle and the shuttle, such relative range of vibration, that at the time the shuttle is forward, the needle raised, and the tension upon the stitch the greatest, the distance between the eye of the needle and the eye of the shuttle and the stitch will be equal, thereby more effectually insuring an equal draft on both threads of the stitch within the body of the cloth. 3d, The combination of the feeding pawl with the feeding lever, to raise and lower the teeth of the pawl, and the inclined plane to vibrate them laterally. 4th, The combination with the feeding pawl of eccentric pin, a pointer, and an index or dial, graduated and numbered, whereby the machine can be adjusted to vary the length of the stitches at will to any required number to the inch, and the number which the machine, as adjusted, will make, can at any time be observed without measurement or calculation, whether it be in operation or not."

90. For an *Improved Machine for Boring Posts and Pointing Rails;* John Young, Middletown, Maryland.

Claim.—"The reversible clamp and feed carriage in combination with the boring apparatus."

91. For an *Improved Self-Regulating Wind-Mill;* John Elgar, Baltimore, Md.

Claim.—"For a double set of wings attached to the arms of a wind wheel, and to act in the following manner: One set, those that are behind the arms in the line of rotation, are stationary in their plane, except in a storm, and furnish the means of a constant power, while the other set, those which are forward of the arms in the rotation of the wheel, are controlled by the wind and springs, so as to act automatically, even in the varying impulse of the wind, and relieving it from danger of injury in a storm."

92. For an *Improvement in Manufacturing Plate Glass from Cylinders;* William P. Walter, Philadelphia, Pennsylvania.

"The nature of the invention consists in flattening the glass cylinder by inserting the flattening instrument into the cylinder in the flattening furnace, and as the glass becomes soft from heat spreading out the wings of the instrument."

Claim.—"The forming of cylinder glass into an oblong shape with two flat sides by my improved flattening instrument."

93. For an *Improvement in Grain and Grass Harvesters;* Abner Whitely, Clark County, Ohio.

Claim.—"1st, So constructing the machine, that when the joint between the frame and tongue is flexible, the latter may, while the team is in motion, be raised and lowered in a sector of a circle whose centre is the finger bar, and thereby enable the operator at once to change the angle of cut, and this, irrespective of the mechanical device by which the motion is produced. 2d, The frame lever, provided with means of fixing its position at will, and linked to the main frame, in combination with the guiding slotted plate, as a means, when used with the flexible joint between the tongue and frame (for moving) of oscillating the frame about the finger bar as a centre, and thus varying the angle of cut, and when used with a rigid joint (for reaping) of raising and depressing the frame and finger bar. 3d, The combination with the links of the receding curve in the bottom of the slots in the plates in which the axis of the driving wheel plays, or of their equivalents respectively, for the purpose of enabling the driver to throw the cutter pinion out of gear. 4th, Suspending the main frame and its attachments from the driving shaft, in order, that whether used in reaping or mowing, the driving wheel and the finger bar may be independently adjustable, and the wheel may rise over obstructions or descend into depressions without altering the angle of cut, or otherwise affecting the cutters."

94. For an *Improved Self-Regulating Wind-Mill;* Benjamin Frantz, Assignor to John Phillips, Waynesborough, Pennsylvania.

Claim.—"Making a direct use of the wind itself for governing wind-mills by means of the wind lever, or its equivalent, connecting rods, collar, and strap rods, in combination with the wings."

95. For an *Improvement in Pneumatic Springs;* James F. Heyward, Wilmington, Del., Assignor to "The Delaware Car Spring Manufacturing Company."

"The nature of the invention consists in employing a fluid piston playing in an air chamber of any form, in such a manner, that when the fluid piston is forced against the contained air, it will compress the same to such an extent as to cause the resistance of its elasticity to balance the force applied. This fluid piston being moved through the intervention of any flexible inextensible water proof bottom securely fastened to the lower margin of the air chamber."

Claim.—"The method of rendering available the elasticity of aeriform bodies in the construction of springs, bumpers, &c., by employing a fluid piston to effect their compression."

JULY 17.

96. For an *Improved Mode of Mounting Ordnance;* Chs. F. Brown, Warren, R. I.

Claim.—"Mounting a cannon or other piece of ordnance in a carriage of spherical, spheroidal, or other circular form, externally, which carriage is arranged to close the port or embrasure through which the piece works, but to turn freely therein in a horizontal or nearly horizontal direction, and which has an opening within it of suitable size and form to receive the gun and to allow it the necessary upward and downward swinging movement on its trunnions, whereby an efficient protection is afforded against the entrance of the enemy's shot or projectiles and the smoke of the discharge is excluded, and at the same time a desirable range in a lateral and vertical direction is maintained."

97. For an *Improvement in Lanterns;* C. H. Butterfield, South Lancaster, Mass.

Claim.—"Attaching a yielding or springing plate to the cap in combination with a match holder, so that lifting or throwing off the cap shall light a match placed so as to light the wick or lamp."

98. For an *Improvement in Window Blinds;* Washington H. Bixler, Easton, Pa.

Claim.—"The attachment of the two fusees connected by a cord, a spring being attached to the one fusee and the cords to the other fusee."

99. For an *Improvement in Nut Machines;* Robert H. Cole, St. Louis, Missouri.

Claim.—"Arranging the movable bottom of the nut box in such a manner in relation to the movements of the punch, that when a nut is being formed in the nut box its bottom will be forced against a yielding support for the purpose of insuring, in all cases, perfectly shaped nuts, and enabling the machine to adapt itself to bars of different thicknesses."

100. For an *Improvement in Invalid Bedsteads;* Benj. Eastman, Philadelphia, Pa.

Claim.—"The apparatus composed of shaft, arms, hooked cords, in combination with the detachable sacking and vertically moving shaft bearings."

101. For an *Improved Method of Operating Valves of Pumps;* Jacob Edson, Boston, Massachusetts.

Claim.—"1st, The peculiarly formed tripper in combination with the curved cap of the valve, by which means a single tripper is made to open both valves. 2d, The twisted partition, whereby the cylinder is divided into two water passages, which deliver the water upon the opposite side from that on which they receive it."

102. For an *Improvement in Machines for Forming Metal Tubes;* Edwin Ells, Ansonia, Connecticut.

Claim.—"Arranging the rotary bur-cutter between the preparatory U shaped die and the rollers, whereby the scarfing operation is performed at the same time as the forming operation, and the forming machinery serves to hold and feed the strip or skelp in a suitable manner to receive the scarfing operation."

103. For an *Improvement in Adjustable Vises;* John Fraser, City of New York.

Claim.—"Having the screw which passes through the movable jaw pass through a nut, so arranged as to turn and cause the screw and movable jaw to turn when wedged or taper-shaped articles are to be held, so that said jaw will conform to the obliquity or taper form of the articles, and cause them to be securely grasped by the jaws."

104. For an *Improvement in Harrows;* William Gourley, Clarke County, Va.

Claim.—"Arranging in connexion with a clod cutter a cutting roller, which may adapt itself to the inequalities of the ground, and also be made to throw its weight upon the clod cutter, or not, as desired."

105. For an *Improvement in Safety Railroad Drawbridges;* John K. Gamble and William P. Gamble, Philadelphia, Pennsylvania.

"The nature of the invention consists in a novel manner of combining and arranging the switch rail and inclined "sideling" with the drawbridge, whereby the switch rails can be unlocked and moved in connexion with the inclined "sideling" and locked simultaneous with the slightest opening of the draw, and again unlocked and thrown in connexion with the main tracks and locked simultaneously with the closing of the draw, or at the moment it is entirely closed."

Claim.—"The contrivances, or their equivalents, so arranged and combined as to constitute a safety railroad drawbridge."

106. For an *Improved Rosin Oil Lamp;* Francis Blake, Needham, Massachusetts.

Claim.—"1st, The air chamber within the lamp in connexion with the circuitous passage. 2d, The button I in combination with the button L and opening, whereby the quantity of air that is admitted to the interior of the flame is adjusted to the height of the button above the wick. 3d, The draft regulator."

107. For a *Fan Blower;* Joseph C. Gartley and Jacob Fox, Philadelphia, Pa.

"Its operation: When the blowing wheel is put in motion by some power applied to the pulley, the external air enters the circular opening on the side B, distributing itself through the air chamber between the slide B and blowing wheel, it is then taken up by the blades E, passing along between the blades, conical hub, D, and rim C, these discharging into the air chamber between the side K, and blowing wheel, then conducted from the air chamber by the pipes H, H, to I, and there discharging. We also claim, where an ordinary parallel hub is used, a circular plate or pieces of plate fastened to the hub and blades E, of blowing wheel, inclosing the greater portion of the side of blowing wheel towards the side K, to answer the same purpose for which the larger portion of the conical hub is intended, which is to prevent a central reacting current after it has passed through the blowing wheel."

Claim.—"The combination, in the manner set forth or shown, for the purposes named."

108. For an *Expanding Auger or Bit;* L. H. Gibbs, Washington, D. C.

Claim.—"The adjustable plate, with the rib, the lip, the index holes in it, combined with the auger, with slot, tapering pins, and set screw."

109. For an *Improvement in Ships Capstans;* John B. Holmes, Assignor to John R. Pratt, City of New York.

Claim.—"The arrangement of the stationary drum head in relation to the stationary base and spindle and movable body, the same being moved by gearing and cranks."

110. For an *Alarm Bedstead;* J. Carroll House, Lowville, New York,

Claim.—"The employment of the tilting frame or bed bottom, in combination with a suitable catch or series of catches connecting it with a clock, in such a manner as to be tilted at any required hour by the action of the clock."

111. For an *Improvement in Railroad Car Coupling;* Aaron G. Heckrotte, City of New York.

Claim.—"The method of releasing the tumbler by double branched sliding guards, combined with the dog bar, whereby the rigid attachment of the box is avoided, and the same rendered capable of attachment to the ordinary spring bumpers. (The invention here considered as an improvement on Bussey's patent of 17th July, 1847, is designed to obviate certain defects in that coupling.)"

112. For an *Improvement in Bedsteads;* Tyler Howe, Cambridgeport, Mass.

"The nature of the invention consists of a bed bottom that shall be perfectly elastic at every point and capable of yielding, so as to conform to the shape of the body, while, at the same time, the slats, of which it is composed, being supported by spring bearings near the middle of their length, do not sag in the centre."

Claim.—"The bed bottom, consisting essentially of the slats and the springs."

113. For an *Improvement in Bottle Fastenings;* Jules Jeannotat, Paterson, N. J.

Claim.—"Forcing a cushion of india rubber, or other suitable material, over or upon the mouth of the bottle by means of a lever inserted in a plate, D, which plate D, has flanches attached to it by rods or links. The plate D also having attached to it a plate G, to which the cushion is secured."

114. For an *Improvement in Trebling a Single Strand and Twisting Sewing Thread;* Harold Kelsea, North Branch, New Hampshire.

Claim.—"The combination of the endless band, its hitching heads or knobs, and the stationary frame hitching knob, as applied together to the drum rollers and twisting mechanism, and made to operate so as to treble and enchain a strand."

115. For a *Wind-Mill;* J. S. Morgan, Highland, Illinois.

Claim.—"Connecting the weights to the wings or sails by means of the cords or chains, said wings or sails being arranged in pairs and connected by pinions."

116. For an *Improvement in Derricks;* Edward Mingay, Boston, Massachusetts.

Claim.—"Attaching to a derrick a lever having its fulcrum in the boom of the same, and actuated by a rope and windlass."

117. For an *Improvement in Apparatus for Heating Feed Water to Locomotive Engines;* David Mathew, Philadelphia, Pennsylvania.

"The nature of the invention consists in an arrangement of a tubular feed water heater, with sectional cones and short exhaust pipes, in relation to each other and to the smoke box, so that the heated gases in their course from the flues to the openings between the sectional cones, cause the heat to act directly against and around them, the exhaust pipes discharging into the low sectional cone and force the current up through sectional cones, causing the current to rush between each sectional cone."

Claim.—"The arrangement of the tubular heater, sectional cones, and short exhaust pipes in relation to each other."

118. For an *Improved Machine for Mortising Window Blinds;* Joseph A. Peabody, Lowell, Massachusetts.

Claim.—"The bar or carriage, N, which carries the blind stile, and which is moved by lever or otherwise, and the changeable and adjustable arms, or their mechanical equivalents, one end of each of them being connected to the bar, while their opposite ends are so connected (by pins or otherwise) to the machine that these arms are changeable and adjustable, so as to impart any desired angle to the mortises. Also, the carriage, B, or its equivalent, which may be vibrated or moved by lever or otherwise, for carrying a series of revolving mortising chisels, this carriage and the chisels attached to it, being so moved, that the chisels will form or cut all the angular mortises in one window blind stile at one operation."

119. For an *Improvement in Attaching Metallic Heels to India Rubber Soles;* S. T. Parmelee, New Brunswick, New Jersey.

Claim.—"Having the metallic rims or casings formed with recesses arranged in a proper way, so that the soft or plastic india rubber, mixed with the proper vulcanizing materials, may be fitted therein, and the rubber and rims or casings be permanently locked together by subjecting the rubber to steam heat and vulcanizing it when fitted within the rims or casings."

120. For an *Improved Wrecking Pump (rotary;)* Oliver Palmer, Buffalo, N. Y.

"The nature of the invention is, 1st, The combination of an angular arm or bucket, so made as to press the water outward from the shaft, with a spiral partition in the suction pipe, which gives the water an initiatory rotation in the direction contrary to that in which the arms revolve. 2d, In combination with the horizontally angular arm and spiral plate, a curve in the vertical face of the bucket, made to induce the water to rise upon the bucket, and more effectually hold it upon it while it is within range of the circle of the arms."

Claim—"The combination of the arms, constructed in any equivalent manner, with the spiral partition."

121. For an *Improvement in Railroad Car Coupling;* John Ryan, Wilmington, Del.

Claim.—"The surfaces of the hook and inside and outside of the buffer mouth, so arranged and constructed, that the hook presented in a vertical position, shall be caused to rotate to a horizontal position on entering, and resume its vertical position when driven in to hold the cars, and by a deviation of the cars to one side, caused to rotate again to a horizontal position, so as to uncouple by said deviation, and the leverage between the hook and head, the buffer mouth not allowing the hook to pass either way, except when horizontal."

122. For an *Improvement in Guides for Sewing Machines;* Frederick R. Robinson, Worcester, Massachusetts.

"The nature of the invention consists in the manufacture of boots and shoes, as well as various garments. It often becomes desirable or necessary when two pieces of cloth or material are sewed together, to run one or more line of stitching parallel to their seam or line of junction, and often very near thereto. It is the purpose of my machinery to effect this."

Claim.—"The combination of the seam gauge or guide with a sewing machine."

123. For an *Improvement in Cross-Head Attachment for Working Steam Engine Valves;* John B. Stott and Alexander Ferguson, Troy, New York.

Claim.—"The method of operating the valves of steam cylinders by a series of trips attached to and sliding with the cross-head of the piston, which trips operate in succession upon the arms of a vibrating shaft connected with the valve rod through cams fixed near the ends of the arms, the trips themselves consisting of a variable and adjustable one to move the valves, so as to cut off the steam before the end of the piston's stroke, leaving the eduction passage slightly open a second, to shift the valves a little further at the end of the stroke, so as to take steam for the new stroke and open wider the eduction passage, and a third to shift the valves, so as to open the induction and eduction passages to their fullest extent. The two first movements of the valve being made by the movement of the cross-head in one direction, and the other by the reverse movement thereof, the last operation being produced by the joint action of the spring cam on the arm and the recessed trip."

124. For an *Improved Machine for Sawing Down Trees;* Matthew Ludwig, Boston, Massachusetts.

Claim.—"Attaching the connecting rod to a sleeve, which works upon a bar, H, attached to the framing; the bar I, of the saw being attached to the sleeve, and the bar, H, having an arm attached to it, which arm has a lever attached, one end of which is provided with a friction roller, which bears against the bar, I, and keeps the saw to its work, in consequence of the cord and weight attached to the opposite end. The bar, H, being arranged, so that it may be turned and allow the saw to cut in a vertical or horizontal position."

125. For an *Improvement in Constructing Iron Ships;* Otis Tufts, Boston, Mass.

Claim.—"Constructing the hull, decks, and bulkheads of ships with a double shell of iron, inter-fastened for greatest strength with binders."

126. For an *Improvement in Metallic Blinds for Doors and Windows;* William E. Worthen, City of New York.

Claim.—"1st, A tubular metallic window blind slat containing in the cavity thereof a non-conductor of heat. 2d, Pivots and grooves, or their equivalents, in combination with metallic slats, capable of vibration and of rising and falling, by which a firm, secure shutter is constituted, while the ordinary uses of inside venetian blinds are still retained. 3d, A locking bar in combination with slats, capable of vibration and motion, in a plane vertical, or nearly so. 4th, Arranging arms to which are attached vibrating chains, and also vibrating chains in a recess separated from the slats proper. And, lastly, a supporting chain in combination with slots capable of vibration and motion."

127. For an *Improved Water Wheel;* William M. Wheeler, Upton, Massachusetts.

Claim.—"1st, Closing the buckets by means of the band or chain in connexion with the arms and springs. 2d, The guard with its slides, operating in the manner and for the purposes described, or any other substantially the same."

128. For an *Improvement in Churns;* Moses D. Wells, Morgantown, Virginia.

Claim.—"The construction of the dasher with an inclined continuous channel for producing the upward flow of a continuous hollow column of cream at each down stroke of the dasher, and thus favoring atmospheric action."

129. For an *Improved Excavating Machine;* Edwin Williams, Covington, Ky.

Claim.—"An excavating shovel or scoop provided with one or more cables, or their equivalents, and having its rear portion or handle hinged to one extremity of a boom which has longitudinal and vibratory motion about an elevated pinion, or its equivalent, the unattached extremity of said boom being made to counterbalance the scoop in the acts of dumping, &c."

130. For an *Improvement in Gas Burning Gridirons;* Edwin D. Willard, Washington, D. C.

"The nature of the invention consists in having two lines of escape holes for the gas, at a distance from the centre upper line of each bar, of one-eighth the circumference of the bar, instead of one row of holes on the centre upper line, this covered with a corrugated plate moving upon ways or slides, and operated by rack and pinion, so as to make the flame act upon each part of the corrugated plate."

Claim.—"The gas burning tubes in combination with a corrugated plate acted upon by rack and pinion, and moving upon slides."

131. For an *Improvement in Looms;* Edward Wood, Philadelphia, Pennsylvania.

"The nature of the invention consists in the construction, arrangement, and operation of the picker stopper of those booms which require a moving shuttle box, so that it shall always be held in a firm unyielding or non-elastic condition when receiving the blow of the shuttle on the arrival of the latter within the said box, and, also, so that it shall be compelled to move out from the point or tip of the said shuttle, so as entirely to relieve the same from all contact therewith, before the shuttle box commences to move, without the use of a rock shaft, cams, springs, or other like objectionable and complicated devices for the purpose."

Claim.—"The rigid or non-elastic picker stopper constructed and arranged upon the lay, and operated by means of the rigid link or curved rod, or its equivalent, when in connexion with said stopper and the frame of the loom."

132. For an *Improvement in Harvesters;* David Watson, Petersburgh, Virginia.

"The nature of the invention consists in so arranging the reciprocating cutters, that the standing grain is gathered by the fingers into acute angled spaces and severed by the receding motion of the cutters, or whilst they are moving towards the acute angle, whereby the straw is held more firmly to the cut than when the cutter is operated at right angles with the travel of the machine, and the cutters being arranged diagonally to the line of motion makes them at least double the length they would be for clearing the same breadth of land if at right angles thereto, so that each finger gathers but half the quantity of straw, which is consequently severed with greater ease and certainty."

Claim.—"The arrangement of a reciprocating cutter or cutters diagonally to the line of motion of the machine."

133. For an *Improvement in Lanterns;* Charles Waters, Brooklyn, New York.

"The nature of the invention consists in the peculiar manner of securing the glass shade in the lantern, and also of securing the lamp within the lantern."

Claim.—"The application of the spring catch and lips."

134. For a *Turbine Water-Wheel;* Heny Van De Water, Troy, New York.

Claim.—"1st, The employment of the guide or concave conical projection at the lower part of the casing in combination with the cylindrical gate. 2d, The chutes or guides placed above the wheel in combination with the slides which form a gate by which the water is admitted in proper quantity upon the wheel and tangentially thereto. 3d, Surrounding the wheel with an annular chamber or recess, in combination with the buckets of the wheel, when said buckets are formed with smaller spaces between their lower ends than their upper ends, for the purpose of causing the water to act upwards against the lower surfaces of the buckets, and thereby relieve the step of the shaft of the weight of the wheel and said shaft."

135. For a *Self-Regulating Wind-Mill;* Joseph Dickinson and Oliver White, Richmond, Illinois.

Claim.—"Applying to a wind-mill or motor a governor or regulator, which shall change the angle of the vanes with the plane of the periphery of the wheel, thus regulating the force of the wind upon them by the force of the wind or motive power alone by means of the face plate, spring, rods, and cranks, or their equivalents."

136. For an *Improvement in Knitting Machines;* John Pepper, Assignor to the "Franklin Mills," Franklin, New Hampshire.

Claim.—"Making the plain work, needle bar, or frame, stationary, its needles movable thereon and to operate in connexion with sinkers, (or their equivalents,) and applying thereto a movable or sliding cam bar, (or its equivalent) so as to operate the plain work needles in succession, the advantage of such, not only being that no forward movements of the sinkers are necessary in order to bring the loops of the yarn into the hooks of the needles, but that such simplifies the machine, and thereby correspondingly diminishes the cost of its construction. And, also, in combination with the hooked sinkers and ribbed needles, the series of cast off sinkers, or those formed without hooks, the same being arranged in the sinker bar, and not only so as to admit the rib needles to work between the hooked sinkers, but so as to render the machine capable of performing either plain or ribbed work. Also, making the rib needle take the place of the front or hook of the sinker in forming the loop for the rib stitch."

137. For an *Improvement in Machinery for Preparing Wool for Combing;* Albert Reinhardt, City of New York, Assignor to N. Schlumberger & Co., Guebeviller, France.

Claim.—"The combination of the feeding, working, and drawing off apparatus, the feeding and drawing off apparatus being so combined, as to be alternately brought into action with the working drum, and brought to a state of rest when not in working contact with the drum."

138. For an *Improvement in Devices for Sealing Preserve Cans;* W. H. Elliot, Plattsburgh, New York.

"The nature of the invention consists in removing water or other liquid from preserve bottles, for the purpose of producing a more perfect vacuum than can be obtained by other means, said liquid being placed in such connexion with a vacuum in the pump, that it will fall by its own weight from the bottle into said vacuum, leaving a perfect vacuum in the bottle, and in the combination of certain devices, which, with or without a liquid in the bottle or vessel to be exhausted, may be used to exhaust the same, and of a device by which the liquid, after it leaves the bottle, is made to assist in sealing the bottle. Said device consisting of a plug or seal, and the tube and plunger for carrying said seal to its place."

Claim.—"The use of the plug, or its equivalent, in sealing exhausted vessels, with or without the tube in connexion with the plunger, or its equivalent."

139. For an *Improvement in Fire Arms;* John A. Reynolds, Elmira, New York.

Claim.—"Constructing fire arms with a hollow cylinder, A, containing chambers in connexion with barrels. Also, loading the chambers by foot pedal, straps, H H, levers, K K, operating the plungers in combination with the simultaneous capping of the nipples by lever N, straps 5 and 6, cross-bar, O, and plungers thereon for removing caps from cylinder P, and placing them on the nipples. Also, drawing the hammer by lever R, and bar S, furnished with spring and catch thereon, or its equivalent, in connexion with the angular liberating projection on spring and the liberating post. Also, drawing the hammer back in combination with the simultaneous swabbing of the discharged chambers. Likewise, the swabbing for containing the swabs furnished with sponge, or its equivalent."

140. For an *Improvement in Fire Arms;* John A. Reynolds, Elmira, New York.

Claim.—"The elevation of the manifold fire arm by the screw nut on swiveled arms in connexion with pulleys and chain, or their equivalents. Also, the adaptation of the shields to the manifold fire arm, or similar machine."

141. For an *Improved Apparatus for Cocking Repeating Fire Arms;* John A. Reynolds, Elmira, New York.

Claim.—"The application of a refrigerator to the barrel or tubes of fire arms for the purpose of keeping said tubes from undue heating."

142. For an *Improvement in Tile Machines;* Gottleib Graessle, Rossville, Ohio; dated June 12, 1855.

Claim.—"The combination of the two endless chains, corresponding moulds, and pressure rollers."

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143. For an *Improvement in Machines for Cutting Sheet Metal;* Cephas Applebee, Lyndon, Vermont.

Claim.—"The combination of the movable bar, its clamps, and one or two sets of rotary cutters, with the index limb or arc, the movable radial supporting arms and their two end shears, the whole being applied together and used to operate on a piece of metal or other material, and reduce it to the shape of an annular section, suitable for being bent into the shape of a conic frustum."

144. For an *Improvement in Machines for Cutting Boot and Shoe Uppers, Soles, &c., from Sheets of India Rubber;* John Arthur and Evan Arthur, New Brunswick, New Jersey.

Claim.—"1st, The cutting or separation of india rubber by placing it on a wet cloth or other suitable moistened surface, and submitting it to the pressure of a heated die having an edge of the form of the article to be cut. 2d, The combination of one or more reciprocating die frames, each carrying a set of dies with a stove, and with carrying and pressing apparatus to carry the sheet or piece of rubber, so that the dies by their reciprocating movement, may be carried into the stove to be heated and then returned to cut or stamp out the pattern or article from the piece. 3d, The method of raising the die frames to carry the dies on their return movement towards the stove, far enough above the roller for other die frames to pass below them, by extending the ends of the side pieces of the said frames some distance beyond the pivots which connect them with the chain, and providing pins for the ends of the die frames to strike against to throw up the opposite ends carrying the dies. 4th, The swinging frame with its fingers to conduct the points or ends of the patterns as soon as they are cut or separated between the roller upon which the cutting is performed, and another roller, by which they are at once prevented curling it, and are conveyed along towards where they are delivered from the machine.

145. For an *Improved Whiffle Tree;* Archibald Bailey, Blue Rock, Ohio, and Danl. L. Allard, Rokebay, Ohio.

Claim.—"In combination with the compound levers, the pivoted cam-shaped catches or hooks for holding or instantly releasing the cock-eyes of the traces, by which arrangement we secure the parts against imperfect action and are enabled to embed all the parts within the single-tree."

146. For an *Improvement in Feeding Water to Steam Pipes by Auxiliary Engines;* William Ball, Chicopee, Massachusetts.

Claim.—"Causing the pipe which conveys the steam from the boiler to the feed engine to enter the boiler at the exact level at which the water is required to stand."

147. For a *Double Reciprocating Split Piston Rod for Pumps, &c.;* John A. Burnap, Albany, New York.

Claim.—"The double reciprocating split rod gear, when arranged and operating longitudinally side by side with the inner faces of the rods bearing against and acting as long moving guides and supports to each other, to strengthen them and prevent lateral shake or play while their exterior is bound and tightened by one packing box, and the two rods or split portions with their respective valves or pistons are free to move separately or in opposite directions to each other, for the admission, discharge, or cutting off of the gas or fluid or for operating by the gas or fluid."

148. For an *Improved Window Blind;* Frank Chase, South Sutton, New Hampshire.

Claim.—"Constructing blinds by nailing or securing oblique or diagonal slats to both sides of a frame, the slats on one side of the frame being opposite to or covering the spaces between the slats on the opposite side."

149. For a *Machine for Turning Cylinders of Wood, &c.;* Matthew F. Connet, Plainfield, New Jersey.

Claim.—"So combining a swing frame, which carries the block to be cut, with a cutter or cutters revolving around a fixed centre, as that the block may be swung up to the cutters and first cut to the required depth or gauge without revolving, and then be revolved slowly on its centres against the action of the cutters to complete the turning at a single revolution of the block."

150. For an *Improved Paging Machine;* F. G. Degener, City of New York.

Claim.—"1st, The guide flanch or guide flanches, in combination with the pawls, stop finger or stop fingers, and ratchet. 2d, The cam or cam-shaped piece, in combination with a rotating reciprocating or vibrating arm and pawls, for the purpose of operating movable series of fingers, so as to produce different combinations, and giving to them, by means of the cam, the requisite motion and time of rest when the machine is in operation. 3d, The combination of the inking table, being surrounded by the figures or characters to be printed. 4th, The combination of the inking table and spring. 5th, The combination of the spring hinge or joint with the roller arm. 6th, The mode of adjustment by raising or lowering the machine."

151. For a *Hydro-Pneumatic Machine for Exhausting and Sealing Vessels;* W. H. Elliot, Plattsburgh, New York.

Claim.—"The yielding lining of mouth, the chamber, with its elastic movable portion, and the lever, with or without the liquid used for expelling the air from the chamber, or their equivalent, when used in combination."

152. For an *Improvement in Machines for Sizing Hat Bodies;* Phineas Emmons, City of New York.

Claim.—"The water box, having the partition or graduating pressure board therein, in combination with the vertical disk wheel having a ribbed or corrugated face and self-adjusting weighted levers."

153. For a *Sawing Machine;* Benjamin Fulgham, Richmond, Indiana.

Claim.—"1st, Placing the reciprocating saw frame, G, provided with a vertical circular saw and a horizontal circular saw within a frame, G, and placing or centering the log to be sawed between shafts. The frame, G, being lowered at every stroke or vibration of the saw frame G, and the log turning simultaneously therewith, a gradually increasing distance at every stroke or vibration of the saw frame for the purpose of cutting "the stuff" an equal thickness direct from the log and in a spiral manner. 2d, Operating the log and frame G by means of the bar attached to the wheel, said bar being attached to the arm, which is secured to the lever, when said lèver is passed through a slotted plate attached to the frame G. for the purpose of gradually increasing the feed motion of the log, and causing the stuff to be sawed of an equal thickness."

154. For an *Improvement in Bridle Reins;* Kingston Goddard, Philadelphia, Pa.

Claim.—"The arrangement of the reins by making the snaffle rein tubular in part to receive the curb rein."

155. For a *Machine for Boring and Mortising Hubs;* Chauncey H. Guard, Brownsville, New York, Assignor to John A. Scroggs and Chauncey H. Guard, New Castle, Pennsylvania.

Claim.—"The arrangement of the levers and the segments with the right and left screws on the periphery of the bit holders, in such a manner, that a proper position of the said levers and segments will cause the rotary motion of the said holders to move them longitudinally either inwards or outwards, and which position may be instantly reversed at the pleasure of the person operating the machine. Also, arranging the rack bars and the upper and lower chisels in such a manner, that the said chisels can be made to simultaneously strike upon opposite sides of the hub placed between them. Also, arranging the rack bars, the supporting and guiding bars, and the regulating screw in such a manner, that the chisels may be made to act in corresponding vertical or oblique directions in forming mortises."

156. For an *Improved Hand Stamp;* Joseph Harris, Jr., and Elbridge Harris, Boston, Massachusetts.

Claim.—"The peculiar oscillating motion of the stamp, also, the same in combination with the inking roll and its adjusters."

157. For an *Improvement in Machinery for Making Rope;* John Harris, North Hoosick, New York.

Claim.—"1st, The method of driving the flyers by means of the cone pulleys and the band or ring, either the said band or ring or the bearings of the flyers having springs applied to keep the pulleys and band properly in contact with each other at all times, and the band or ring being movable in the direction of the axes of the flyers to come in contact with a larger or smaller part of the cone pulleys, and thus vary the speed of the flyers and the twist of the strands while the machine is in operation. 2d, Making the cans of polygonal form to fit snugly between the pillars or side pieces of the flyers, in combination with the springing collar applied to fit over the top of the can, whereby the cans are enabled to be quickly taken from the flyers and replaced."

158. For *Improvements in Machines for Cutting Files;* Horace Hotchkiss, Waterbury, Connecticut.

Claim.—"Supporting the file blank upon a compound carriage having both a rotary and a lateral adjustment horizontally, while the cutter is adjusted only in a plane passing through the apex of the cutter and bisecting its edge, and is at the same time perpendicular to the edge of the cutter and to the plane of the file carriage. Also, placing the cutter in line with the hammer and in the same adjustable frame therewith, so that when the position of the cutter is changed by an adjustment of this frame, the hammer shall also be adjusted by the same operation to conform to the position of the cutters."

159. For an *Improvement in Carriages;* Moses G. Hubbard, City of New York.

Claim.—"The cross bar for attaching the forward axle to the other parts of the running gear and bar for the king bolt."

160. For an *Improvement in Stalls for Horses, &c.*, John Jenne, Bethany, N. Y.

Claim.—"1st, The swinging partitions. 2d, The doors in combination with the planks. 3d, The sleeves in combination with the chains, to prevent the animal from injuring himself by rubbing against the chains."

161. For an *Improvement in Machines for Making Railway Chairs;* James Kelsen, Canton, Mass., Assignor to self and George Banks, East Boston, Massachusetts.

Claim.—"Combining with each of the punches and its driver, a lifter and mechanism for operating such lifter, such punch being applied to the bending die and supported on a spring. (The chairs of wrought metal.)"

162. For an *Improvement in Parlor Stoves;* Francis Kenney, Springfield, Mass.

Claim.—"The arrangement of the pipes, M, tubes, chamber, and pipe, I, when provided with the dampers."

163. For an *Improvement in Making Gutta Percha Boats;* Edwin B. Larchar, Baltimore, Maryland.

Claim.—"The method of making a safety boat or other vessel of gutta percha mixed with glue, so that the air chambers or other parts, if separately formed, may, together with the boat body, be united and completed at one pressure, or, that if the braces, knees, thwarts, supporters, or other accessions to the boat proper are solid, the whole with the inner and outer forms may all be made or completed together at one time and at one pressure. (One ounce of glue to every pound of gutta percha.)"

164. For an *Improvement in Processes for Smelting Iron;* Samuel Macferran, Philadelphia, Pennsylvania.

Claim.—"The use of gas carbon as a fuel in the process of smelting iron."

165. For an *Improvement in Processes for Hulling Cotton Seed;* Daniel W. Messer, Boston, Massachusetts.

Claim.—"Separating the kernel from its shell and fibre previous to expressing the oil by the method described, or by any other method substantially equivalent thereto, the seed being macerated to soften the shell, and then submitted to pressure for the purpose of pressing out the kernel."

166. For an *Improvement in Apparatus for Administering Pulverulent Medicines;* Jonas Moore and D. P. Adams, Marietta, Ohio.

"The nature of the invention consists in facilitating the administration of nitrate of silver, by grinding it to fine dust to be inhaled."

Claim.—"The combination of the machinery for turning the emery wheel with a discharge pipe, for the purpose of administering pulverulent substances in cases of inflammation of the mouth and throat."

167. For a *Balance Water Gate;* E. N. Moore, Lenox, Pennsylvania, and Isaac B. Hanyan, Chester, New York.

Claim.—"Constructing a water gate by having two disks or plates of proper form attached to opposite ends of a shaft, which passes transversely through a box, said disks bearing against the projections on the sides of the box and over openings in the sides of said box."

168. For a *Water Metre;* Henry R. Worthington, Brooklyn, New York.

Claim.—"The employment of two cylinders, which may be distinguished as cylinders Nos. 1 and 2, with pistons working in the same, so arranged and combined with regard to each other, as that the motion in cylinder, No. 1, shall actuate the supply and delivery valve of cylinder, No. 2, while, in like manner, the motion of the piston in cylinder, No. 2, actuates the supply and delivery valve of cylinder, No. 1, thus producing a positive and direct motion."

169. For an *Improvement in Hinges;* Joseph Plegar, Birmingham, Pennsylvania.

Claim.—"Making a bolt on the pin part of the hinge and a cup or socket in the upper section of the hinge to receive the bolt."

170. For an *Improvement in Shuttle Guides for Looms;* Horace T. Robbins, Lowell, Massachusetts.

Claim.—"An improvement on my former invention, which was patented September, 14th, 1852, which consists in furnishing the shuttle guides with pulleys, or their equivalents."

171. For an *Improvement in Wagons;* Joseph Thornton Russell, Tyler County, Va.

Claim.—"The construction of the "standard receiver," and the application thereof to wagon bolsters."

172. For *Hydrodynamic Friction Joints;* Thure Emanuel Sandgren, Wilmington, Del.

Claim.—"The forming of a hydraulic bearing for a rotary shaft by means of the water ducts passing through the cylinder or case, in which the shaft rotates, for the purpose of supplying water as a lubricator to the rubbing surfaces."

173. For an *Improvement in Preparing Potash and Soda;* George Thompson, East Tarentum, Pennsylvania.

Claim.—"The use of a tray and sector, constructed for the purpose of dividing caustic soda or potash into parcels of convenient size and shape and of uniform weight. (The potash or soda being in a melted state.)"

174. For an *Improvement in Seed Planters;* Pierpoint Seymour, East Bloomfield, New York.

"The nature of the invention consists in the mode of regulating the delivery of the seed from the seed box, with the apparatus therefor, and the double or additional seed box for sowing broad-cast while drilling."

Claim.—"1st, The combination of the movable side of the seed box with angular hangings, spring, and inclined planes or wedges, or their equivalent, for the purpose of opening and closing said box and to regulate the quantity of seed or substance to be delivered. 2d, The side plate to prevent the seed from clogging. 3d, The combination of the angular levers, having their fulcrum or inclined standards, or its equivalent, with the rods linking them to the drill tubes."

175. For an *Improvement in Washers for Axles;* Alfred E. Smith, Bronxville, N. Y.

Claim.—"Inserting blocks of metal, or other equivalent hard substance, in packing washers made of leather, or other equivalent flexible and yielding substance."

176. For an *Improvement in Oscillating Valves and Gearing for Pumping Engines;* Charles A. Wilson, Newport, Kentucky.

Claim.—"1st, Balancing oscillating valves under all lateral pressures on the exterior arising from steam or air, and regulating the exhaust ports. 2d, Balancing the end pressure in the interior caused by steam in conical valves by the annular recess, *b b*, equal and opposite to *a a*, and the balance piston or steam valve on a beveled seat. 3d, Supporting the tripping apparatus consisting of the angle, trip lever, toggle joint, and upper lever, or their equivalents, so as to relieve the valve from all weight and consequent friction and wear. 4th, Using the safety arm to insure and regulate the cut-off, and the cam jogs of depth regulated by cutting set screws, or other equivalent device for operating the same. 5th, Using the independent rod attached to the piston of the steam cylinder for working the valve gear, whereby bringing the steam cylinder and pump close to each other, space is economized while power is gained."

177. For an *Improvement in Refrigerators;* William Mootry, City of New York.

Claim.—"1st, The application and employment of a vessel or chamber for containing both the ice and water together, serving the double purpose of a water cooler and frigorific body, in combination with the ordinary refrigerating box, chamber, or other insulated non-conducting cooling apparatus. 2d, The mode of ventilating by compelling the outer atmospheric air before entering the interior to come into mediate contact with the ice or other frigorific body. 3d, The mode of ventilating in combination with the cooler and refrigerating chambers."

178. For *Improvements in Grain and Grass Harvesters;* Jesse Urmy, Wilmington, Delaware.

Claim.—"1st, In combination with the driving wheel placed inside the gearing, the angular tongue for preventing side draft and at the same time allowing the horses to walk on the side of the standing grass or grain. 2d, The use of the balanced dogs under the driver's feet for throwing the cutting apparatus in and out of gear. 3d, Making the parting and gathering board hinged and adjustable. 4th, Regulating the size of the sheaves by means of the several ranges of gearing within the driving wheel, in combination with the adjustable pinion."

179. For an *Improvement in the Union Platform Scales;* Augustus Sanborn, Assignor to E. & T. Fairbanks & Co., St Johnsbury, Vermont.

Claim.—"The manner in which the platform lever and the vertical suspension rod, *b*, of the pan and steelyard are connected and supported, the rod, *b*, being jointed at its lower end to an arm independent of the lever, and said lever connected to the rod, *b*, by means of a pendulous rod, *h*, and a pointed or knife edge bearing arranged near the upper part of the rod *b*, the same while securing a vertical movement to the rod *b*, (the only one which it should have) effecting the advantage of allowing the lateral vibrations of the lever to take place without disturbance of the steelyard or rod *b*."

180. For an *Improvement in Furnaces for Treating Zinc Ores;* Samuel T. Jones, City of New York.

Claim.—"The double use of the chimney by combining the said chimney governed by a damper or register with the furnace and collecting apparatus and interposed between the two, whereby, the iron contained in the ore can be worked after the zinc has been worked and collected."

181. For a *Machine for Feeding Paper to Printing Presses;* Andrew Campbell, Newark, New Jersey.

Claim.—"1st, The mode of operation, by which the pile or piles of sheets is or are moved up or down and kept in position as the sheets are taken from or laid on the pile, that the upper sheet of the pile may, at all times, be in the proper position to be acted upon by the mechanism which removes it, or which deposits it, which mode of operation consists in lifting or depressing the table or tables on which the pile is placed by the mechanism described, or the equivalent thereof, in combination with the gauge and holding bar, or any equivalent therefor, which rests on the top sheet to hold it down, and which, by its position on the pile and its connexion, governs and controls the movements of the lifting or depressing mechanism, the said mode of operation being employed to govern the position of the pile on the feeding and receiving tables, or either. 2d, The mode of operation for holding the upper sheet of the pile on the receiving table on which the sheets are in succession deposited, so that as the sheets are drawn over the pile in succession, the sheet previously deposited shall not be moved from the position in which it was deposited, the said mode of operation consisting in the use of a wing or plate which rests on the upper edge of the pile at that end of it over which the sheets move as they are drawn over the pile, and which then rises to permit the newly deposited sheet to fall, and again descends to hold it preparatory to the introduction of another sheet, the said wing or plate being operated in the manner substantially as described, or any equivalent therefor. And this, whether the said wing or plate be employed for the sole purpose of holding the upper sheet of the pile on the receiving table, or for this and for the purpose of gauging and controlling the mechanism which depresses the receiving table. 3d, Making pressure on the surface of the pile of sheets on the feeding table and within a short distance of the edge, which is to be lifted for the purpose of forcing the sheets at that end of the pile to open fan-like, that the separation may be more effectually made. And this, whether the required pressure be made by the rounded surface on the exhaust bar or by a separate bar having the like mode of operation. 4th, Making the surface of the exhaust bar concave, so that the upper sheet, which is to be removed from the pile, shall be drawn into the said concavity, and thereby draw its edge within the edge of the pile the more effectually to insure the separation. 5th, Placing the concave surface of the exhaust bar, so that it shall overlap or extend beyond the edge of the pile, that the whole of that portion of the sheet which is to be acted upon by the exhaust may be within the concavity of the exhaust bar, thus causing the inward current to pass upwards under the projecting concave surface of the exhaust bar and across the edges of the pile to insure the separation of the edges of the sheets. 6th, Blowing in a current of air at one or both ends of the concavity of the exhaust bar, to insure the separation of the top sheet from the rest of the pile preparatory to removing it from the pile. 7th, The employment of the transferring or holding bar connected with the exhaust and blowing bellows, or equivalents therefor, in combination with the exhaust bar, by means of which, that end of the top sheet which has been separated from the pile, is transferred from the exhaust bar to, and held by the said transfer bar until it is taken by the gripers, or any equivalent therefor, that the exhaust bar may be removed preparatory to carrying off the top sheet. 8th, The method of thumbing the edge of the pile to insure the separation of the edges of the sheets where they are liable to adhere, by means of the rotating spring flippers, or any equivalents therefor. 9th, The mode of operation, by which the griping end of the jaws which gripe the sheet of paper, are made to maintain a fixed position relatively to the edge of the sheet held by the transferring and holding bar during the entire operation of griping the sheet, and during a portion of the operation of reversing the jaws by the continued motion of the endless chain or band with which the rear part of the jaws are connected. 10th, Removing the sheets in succession from the pile by griping one end of each sheet in succession with griping jaws after the end has been separated and lifted from the pile by other means, and rolling it off the pile by the motion of the griping jaws towards the other end of the pile, by which all tendency to disturb the sheets below is avoided. I do not claim broadly the fact of rolling off the sheet from one end of the pile towards the other, but limit my claim to the mode of operation specified, by which I attain this end in a practical and efficient manner. 11th, Making friction on both surfaces of the sheet when brought over the pile on the receiving table in combination with the gripers, so that the moment it is liberated by the jaws, the friction on both surfaces shall hold and leave it in place on the pile, whereby the accurate deposite of the successive sheets is made to depend solely on the period of opening the jaws. 12th, Making pressure on and packing the pile of sheets on the receiving table as each sheet in succession is deposited, by means of a perforated plate, the perforations in the plate giving free access to air, that the plate may be lifted without drawing up the sheets with it. I do not claim broadly making a pressure on the pile, except by means of a perforated plate extending over the entire pile to pack down the entire surface, the small perforations preventing the sheet from being lifted whilst they do not prevent the packing down of the pile. And, finally, the employment of pointed punches to punch holes in the sheets as they are piled on the receiving table, so that the pile may be transferred and moved without shifting the position of the sheets relatively to each other in the pile."

182. For an *Improvement in Candle Mould Apparatus;* Willis Humiston, Troy, New York.

Claim.—"Making the top of the piston, in which the tip of the candle rests, movable on the piston, so that it may remain in contact with the candle whilst the piston is slightly depressed or lowered to bring it up with a sudden blow to start the candles from the moulds. Also, in contradistinction from clamping the wicks or from a tip bar or supporter, the clamping of the candles themselves in the position in which they are forced from the moulds, and thus holding them until ready to be removed, by which means I retain greater facilities for pouring into or filling the moulds and avoid the danger of breaking the candles or their tips."

183. For an *Improved Printing Press;* Merwin Davis, City of New York.

Claim.—"1st, The oscillating bed, having a plane surface, and contradistinguished from a rotating or sliding bed by oscillating between two given points. Also, the construction and operation of the platen in combination with said bed. Also, the adaptation and combination of the well known fly for laying the sheets, the slide for the reception and the delivery of the paper, and the inking apparatus to the new construction and arrangement of the bed and platen."

184. For an *Improvement in Propellers;* Augustin Dubace, Brooklyn, New York.

"The nature of the invention consists in giving to each blade two motions, the vibratory motion in the plane of a vertical cross section of the vessel, and the reciprocating rotary motion on its axis, by jointing the arbor of the blade to the vessel with a ball and socket joint, or its equivalent, in combination with an arm projecting from the said arbor above its ball and socket joint, the end of which arm is connected by a slipping and ball and socket joint, or the equivalent thereof, with a wheel or crank arm on the driving shaft, the arbor of the blade being kept in the plane of the vertical cross section by suitable guides, or their equivalent, whereby, as the driving shaft rotates, the end of the arm at its connexion with the slipping and ball and socket joint, is made to describe a circle, which imparts to the blade the lateral vibratory motion towards and from the vessel's side, as well as the reciprocating motion on its axis to reverse the direction of its obliquity, this latter motion being mainly imparted to the blade at the end of each lateral vibration by reason of the passage of the end of the arm at the upper and lower dead points of the crank-like motion."

Claim.—"Connecting the blades with the sides of the vessel by means of a ball and socket joint, or any equivalent therefor, in combination with an arm projecting from the arbor of the blade, the end of which arm is connected by a sliding and ball and socket joint, or any equivalent therefor, with a wheel or crank arm on the crank."

185. For an *Improvement in Cheese Presses;* George R. Comstock, Manheim, N. Y.

Claim.—"The roller in the lower portion of the pressing gate, and brought into action by the rising of said gate in the removal of the pressure."

186. For an *Improvement in Bottle Fastenings;* John Allender, New London, Conn.

Claim.—"The strap constructed with hinge and hook for holding in and releasing the corks or stopples of bottles, jugs, &c."

187. For an *Improvement in Wrought Iron Shafts;* James Montgomery, Baltimore, Maryland.

Claim.—"The construction of a hollow compound shaft by means of the bars and wedges arranged and welded together only at the journals or bearings, while the bars are separated by sufficient spaces at all other parts."

188. For an *Improvement in Starch Making,* Henry Colgate, Jersey City, N. J.

"Process: Dissolve one hundred pounds of refined sugar in sixty gallons of clear cold water, and mix it with the starch just after the starch is separated from the gluten in the cisterns, stirring the solution well together. One pound of sugar to every thirty pounds of starch."

Claim.—"The process of manufacturing starch, by adding to it in the process of making, a certain amount of sugar."

189. For an *Improvement in Calender Clocks;* John Williams, Hartford, Conn.

Claim.—"Completing the revolution of the wheel, B, at the end of the shorter months by means of sliding teeth, which are suitably attached to the said wheel, and severally or collectively, as required, brought into such positions, as to enable them to be acted upon by the teeth on the daily revolving wheel, A, by means of the "four year wheel," D, which is on the same arbors, but independent of the wheel B, the said wheel D acting upon the said sliding teeth by means of its forty-eight projecting and receding divisions, and by pins or teeth arranged upon it, and being for that purpose moved one forty-eighth part of a revolution independently of the wheel B for every revolution of the said wheel B."

190. For a *Machine for Dressing Lumber from the Log;* Albert Walcott, Detroit, Michigan.

"The nature of the invention consists in the planing, tonguing, and grooving, matching, or otherwise dressing in the solid timber before sawing, or in connexion with sawing after the logs have been sawed into cants or thick plank of the desired thickness to make the width of the desired dressed stuff, or, in other words, the dressing and the sawing at the same time, the dressing only preceding the sawing by the distance between the dressing machinery and the saw, as the cants or plank are moved forward past the dressing machinery first, and then the saw at one and the same time and on one and the same machine. The first process of the operation consists in sawing into cants or plank of the desired thickness to make the required width of dressed stuff. The second process is —place one of such cants or plank on some kind of a carriage which may be made to traverse in a direct line, without variation, as near as possible, by machinery, forwards and backwards, something more than the length of the stuff to be manufactured, in a similar manner to the common siding mill, for sawing siding, now in use."

Claim.—"The particular arrangement and combination of mechanism for manufacturing and dressing out lumber from the log, or plank, (as the case may be,) by successive operations, and in any manner substantially the same, not confining myself, however, to any particular arrangement of mere mechanical details or devices to effect the desired result, that is, a piece of lumber finished or partially so (as the case may be) for building and other purposes."

191. For *Improvements in Machinery for Dressing and Carving Stone;* Elias A. Swan, Brooklyn, N. Y., and De Witt C. Smiley, City of New York.

Claim.—"1st, The method of dressing, carving, or cutting stone, or similar rigid and unyielding substances, by the use of a rotating cutter, whose cutting edge is spiral or at an incline with the axis of said rotating cutter; thereby the cutting edge always operates obliquely on the material under treatment, and effectually prevents any blow on the stone that would produce a vibration of the machine or break the cutter or stone. 2d, The method of fitting a horizontal or inclined rotating cutter, so that it can be kept radially with any curved mould or cut it may be forming, viz: by the use of the yoke and parts attached."

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192. For an *Improvement in Washing Machines;* John H. Atwater, Kalamazoo, Mich.

Claim.—"The arrangement of the washing frame and the endless platform of slats, together with the respective parts combined therewith, in such a manner, that the same first mover will, at the option of the operator, simultaneously impart a reciprocating movement to the washing frame and a forward or a rearward movement to the said platform, or operate the said washing frame."

193. For an *Improved Method of Feeding Planks to Planing Machines;* Nelson Barlow, Newark, New Jersey.

Claim.—"The self-adjusting frame connected by axles, or any equivalent means, to the main frame, when combined with the cylinder and fixed rollers."

194. For a *Fan-Blower;* Simon Barnhart, Chillicothe, Ohio.

"The nature of the invention consists in making each of the blades with a flanch or lip on one of its sides, said flanch or lip being straight or at right angles with the blade from the tip to the centre of the same, and therefrom is bent down and made to extend obliquely outward, in such a manner, that a small spiral wing is formed on each blade, which extends outside the case through the inlet air passage of the same, and as the fan revolves, collects and forces an additional quantity of air into the case."

Claim.—"Providing each of the blades of the fan with a lip or flanch."

195. For an *Improvement in Washing Machines;* Oliver D. Barrett, Fulton, N. Y.

Claim.—"Providing a pail with a foot piece and treadle, in combination with the connecting rod, lever, and sectors operating the rollers, by which combination the rollers are thrown apart by their own weight, and brought together by means of the foot and the action of the mop in being pulled out between them."

196. For an *Improvement in Air Engines;* John Ericsson, City of New York.

"The application of the caloric in this engine is identical with that of the air engine, for which I obtained patents in England and other countries in the year 1833, descriptions and drawings of which have been published in several works, among which may be mentioned a work called "Dictionary of the Arts of Life and Civilization," by Sir Richard Phillips, published in London, 1833. This work contains a correct delineation and description of my said air engine."

Claim.—"The method of supplying fresh air to the engine, compressing and transferring to the regenerator and heater, or either, by the action of the supply and working pistons within the one cylinder, whereby the air is admitted under atmospheric pressure as the supply piston is moving from the working piston, as the previous charge of heated air is exhausting, so that the said supply piston moves in equilibria, or nearly so, and by which, also, the supply air is finally compressed and then transferred to the regenerator and heater, or either, as the supply piston moves between the supply air and heated air during the period of the nearly stationary position of the working piston. Also, in combination with the double piston movement of each cylinder, the method of connecting the working pistons of two single acting engines, to constitute a double acting engine, by means of two sets of vibrating arms attached to each other and vibrating on a common centre, connected with the two working pistons and with the two cranks on opposite sides of the crank shaft, the two sets of arms acting on the principle of the bent lever, and the crank shaft being so located relatively to the cylinders and the centres of vibration of the arms, that the working piston shall be at the end of its inward stroke, at the time the crank is passing the dead point farthest from the point of connexion of the connecting rod with the vibrating arm, by which the power of that working piston, which is being impelled by the heated air, is applied to the best advantage to operate the other working piston during its return stroke, and by which, also, the working piston remains nearly at rest during the time the supply piston is making that part of its outward stroke, during which the partially compressed air is finally and fully compressed and transferred to the regenerator and heater, or either."

197. For an *Improved Machine for Ruling and Paging Paper;* John A. Elder, Westbrook, Me., and John Richardson, Portland, Maine.

Claim.—"1st, The arrangement of machinery for the ruling, printing, and paging paper for the manufacture of blank books, or other like purposes, when the ruling printing, and paging is done before the paper is removed from the car or table where it is ruled. 2d, Also, the combination of a car or table and ratchet bar with its type rods, or their equivalents. 3d, Also, the pliers or nippers for the purpose of removing the paper from the car or table."

198. For an *Improvement in Machinery for Sizing and Dressing Warps;* John A. Elder, Westbrook, Maine, and Ephraim Wood, Winthrop, Maine.

Claim.—"The regulation of the speed of the yarn beams and rollers of the dressing frame by the tension of the warps, namely, by the combination of the vibrating roller, N, with the rollers L and I, rod, and the hook, or the equivalents thereof, and these in combination with the ratchet, lever, friction pulley, and weight, or their equvialents."

199. For a *Cross-Cut Sawing Machine;* Frederick Field, Toledo, Ohio.

Claim.—"The arrangement of the two circular saws hung in a vibrating frame, in combination with the mode of throwing the feed motion in and out of gear."

200. For an *Improvement in Vault Covers;* James Harrison, Jr., Milwaukie, Wis.

Claim.—"Attaching the cover to the upper part of the opening or passage of the vault by means of the jointing arms or rods, arranged as shown, or in an equivalent way."

201. For an *Improvement in Sewing Machines;* James Harrison, Jr., Milwaukie, Wis.

Claim.—"1st, Feeding the material to be sewed by means of a feed plate, which is guided in the direction of any curved circuitous or irregular line of sewing by means of grooves, or their equivalent, on its back side, of a form corresponding to the said line, receiving or working in contact with fixed pins, or other equivalent fixed guides, whereby motion is only allowed to the said feed plate in such direction as to make the material desirable in passing the needle, the intended line, the said feed plate receiving motion by any mechanical device suitable for the purpose. 2d, Combining the guide pins, or their equivalents, with the shoe which confines the feed plate, and produce the necessary pressure of the plate on the material."

202. For a *Machine for Sawing Ratan;* Liveras Hill, Charlestown, Massachusetts.

Claim.—"The arrangement of the rectilinear moving carriage, the adjustable holding bearer, the groove pressure roller, and the saw, whereby, when a stick of ratan is clamped to the adjustable bearer and the carriage is moved forward, so as to carry the said stick endwise against the saw while the latter is in revolution, such stick shall be sawed in a diagonal direction."

203. For an *Improvement in Machines for compressing Puddlers' Balls and other Masses of Iron;* Solon S. Jackman, Lock Haven, Pennsylvania.

Claim.—"The compressing puddlers' balls or similar substances by means of circular compressers, so arranged, that their peripheries shall have different degrees of speed, and their surfaces in contact with the mass to be operated on shall cause its rotation upon its own axis, and by compression between them, reduce the metal into a bloom."

204. For an *Improvement in Washing Machines;* Josee Johnson, Washington, D. C.

Claim.—"The arrangement and combination of disk, pestles, and spiral springs, or their equivalents, which form the pounder."

205. For a *Circular-Saw Mandrel;* Fielding H. Keeney, Newport, Kentucky.

"I make a shaft in the ordinary way, with bearings in any of the known ways. Then, instead of using a tight collar for the saw to rest against, I make a collar or collars with a hole larger one way than the other, with a pin or pivot through the collar and shaft, so that it may move back in an oblique direction on the shaft by screwing up or unscrewing the set screws, which screw in a stationary collar on the shaft, so that the set screws may set at right angles with the pin in the vibrating collars. The set screws also rest against a collar or washer, so that when screwed up again, the saw may hold it tight and firm between the collars at right angles with the shaft, or at any angle proper, so that as the shaft revolves, each part of the saw may cut its each part of the kerf or groove, thereby cutting it at any breadth (you may see proper to set it) at one cut or each revolution of the saw."

Claim.—"The mode of making a mandrel (as above described), not confining to exact size or shape, but to the principle of the machine, or any other equivalent device."

206. For an *Improvement in Distilling Coal with Hydrogen Gas;* Stephen Meredith, Meadville, Pennsylvania.

Claim.—"The production of naphtha, benzole, and other hydro-carbon liquids by the distillation of cannel or other bituminous coal, in an atmosphere of heated hydrogen gas, or in a retort to which a stream of heated hodrogen gas is admitted during the distilling process."

207. For an *Improvement in Cut-Off Valves for Steam Engines;* Frederick Perry, Newark, New Jersey.

"The nature of the invention consists in substituting steam pressure for holding the cut-off valves to their seats on top of the main valve, instead of using springs as heretofore."

Claim.—"The combination of the channels and hales with the cut-off valves and exhaust recess, or their equivalents, for the purposes set forth, or any other purpose for which they are suitable, merely modifying the parts to suit circumstances, when the principles involved are the same."

208. For an *Improvement in Artificial Legs;* Wm. H. Rhodes, M. D., Berlin, N. Y.

Claim.—"1st, The knee joint and ankle joint. 2d, Also, the standard and brace with their hinge joint connexion to foot plate, coiled spring, with rollers to hold the same, which retains the brace and standard in position when walking. The principles and improvements when united forming the apparatus."

209. For an *Improvement in Ventilating Hats;* William Sellers, City of New York.

Claim.—"1st, Making the hat or other similar head covering to open at its side or sides, by dividing the body of the hat and connecting or arranging the separated portions or sections of the body, so that the one portion of the body may be adjusted to form an open or close connexion with the other portion of the body. 2d, Providing the divided body at the junction of the two sections with a gimp guiding strip, or reticulated telescopic lining or casing, arranged for operation in connexion with the movable section of the body, whereby an ornamental and unbroken appearance is given to the hat all round when the body of it is open for ventilation."

210. For an *Improvement in Sewing Machines;* Isaac M. Singer, City of New York.

"The nature of the invention consists in combining with the vibrating feed plate and spring or pressure pad a lifter below the cloth, which, at the appropriate time, is moved up to lift the cloth from the feed plate and against the downward pressure of the pad, that the feed plate may make its back motion without carrying back the cloth with it, the said lifter being then depressed to permit the cloth to descend on to the feed plate preparatory to the feed motion."

Claim.—"The combination of the lifter with the vibrating feed plate and pressure pad."

211. For an *Improvement in Excluding Dust from Railway Cars;* Elam C. Salisbury, City of New York.

Claim.—"The method of preventing the dust, which is agitated and thrown upon the track by the passage of a train, from rising up and entering the doors, windows, and other apertures of cars, by inclosing the sides of the train from the bottom of the cars to within a short distance of the track, and closing up the spaces between the platforms of the several cars."

212. For an *Improvement in Water Gauges for Steam Boilers;* Paul Stillman, City of New York.

Claim.—"The construction and arrangement of glass water gauges, with the cocks having the axes of their chambers and keys in line with that of the glass tube, and the chambers having double water ways, and the movable guard rods supported by lugs on the chambers."

213. For an *Improvement in Musical Reed Instruments;* George S. Shepard, Canaan, New Hampshire.

Claim.—"The combination of the auxiliary sounding chamber and the swell chamber with the valve chamber."

214. For an *Improved Bucket for Water-Wheel;* C. C. Taylor, Delafield, Wis.

"The nature of the invention has reference to the class of wheels known as percussion reaction wheel, and consists in constructing the bucket of a double inclined plane for bottom, and widening from top to outlet, so as to make the outer side of the bucket a conical surface, the upper inclined plane being perpendicular to the bottom of the water issue for receiving the percussion of the water under the most favorable circumstance."

Claim.—"Swelling the outer portion of the bucket into a conical surface and combining the same with the double inclined plane."

215. For an *Improvement in Soap Cutting Machines;* Anton Van Haagen, Cincinnati, Ohio.

Claim.—"The ranges of vertical wires at right angles to each other, in combination with the drivers moving at right angles to each other and the ranges of rollers, for the purpose of cutting blocks of soap directly into slabs and bars at one operation and without handling thereof."

216. For an *Improvement in Soap Cutting Machines;* Anton Van Haagen, Cincinnati, Ohio.

Claim.—"1st, The arrangement and combination of a series of wires for cutting soap, said wires being stretched by means of springs for the easy formation of a loop at the commencement of cutting and gradual increase of tension until the wire has entered the block. 2d, The combination of grooved carriage, grooved driver, stationary and vertical range of horizontal wires and descending horizontal range of horizontal wires, for the purpose of slabbing and barring a block of soap without handling the latter after it is once placed upon the machine. 3d, The bed or carriage and driver scored transversely by grooves adapted to the loop of the wires."

217. For a *Method of Operating Steam Valves;* Norman W. Wheeler, Cincinnati, O.

Claim.—"1st, Actuating the induction and eduction valves of any double acting reciprocating steam engine by means of steam pressure derived from the working cylinder, and released therefrom by the passage of the working piston over and beyond appropriate ports, when the pistons, or their equivalents, upon which such pressure acts, are so arranged, that no movement of the valves shall result from the passage of the working piston over the first of two or more such ports in any full stroke. 2d, Releasing the steam contained between pistons of unequal areas by the passage of the larger one over its exhaust port, and stopping the supply between the same pistons by the passage of the smaller one over its induction port."

218. For an *Improvement in Direct Acting Hydraulic Steam Pumps;* Henry R. Worthington, Brooklyn, New York.

Claim.—The mode of counteracting the resistance to the motion of the pump piston in direct action pumping engines by which the steam valve is moved, that is to say, by making a passage into the pump chamber or cylinder, so arranged, that said passage or opening shall, for a time, be uncovered or disclosed at or near the end of each stroke of the piston, by which the fluid, which is beyond or above the force valves, passes behind the water piston, and makes pressure thereupon in the direction of said piston's motion."

219. For an *Improvement in Writing Desks;* William G. Wolf, Philadelphia, Pa.

Claim.—"The horizontal inclined levers, and inclined and declined planes, with the upright traveler working thereon, which causes a graduation, that of a desk to be formed or else entirely concealed, at pleasure, using for that purpose the horizontal inclined levers, inclined planes, and upright traveler."

220. For an *Improvement in Washing Machines;* Samuel M. Yost, Connersville, Ind.

Claim.—"The arrangement of two corrugated rollers, one above and washing into the other without coming into contact in the lowest lines, and each being tightly covered with canvass or other strong material, the whole combined and operating in such a manner, as to effectually wash any cloth submitted to it, and without breaking the buttons or other similar hard substances upon the linen or cloth."

221. For an *Improvement in Seeding Machines;* Lucien N. Bigelow, Cuba, N. Y.

Claim.—"The use of a screen for the purpose of sowing grain broad-cast, so arranged with a feeding hopper and slides, as to regulate the quantity of grain to be sown when acted upon by trip-hammers to secure its uniform and proper distribution."

222. For an *Improvement in Hot Air Furnaces;* Samuel A. Briggs, Providence, R. I.

Claim.—"The passage leading from the chamber to the hot air chamber in combination with the damper, crank, and rod."

223. For an *Improvement in Ovens;* John P. Hayes, Philadelphia, Pennsylvania.

Claim.—"1st, The pipes or hot air flues extending up one or more of the heating flues of an oven, the same opening into the oven near both the top and bottom of the same, so as to form a communication between the upper and lower strata of air in the said oven through the gas flue or flues in which they are located, and the said flues opening also near the bottom of the same to the outside of the said oven for the purpose of admitting fresh air into the oven. 2d, Making the partition plate so as to move or yield upwards, when the same is used in combination with the movable box or lining of an oven, for the purpose of allowing the ready admission or withdrawel of the said movable box, as occasion may require."

ADDITIONAL IMPROVEMENTS FOR JULY, 1855.

1. For an *Improvement in Screw Wrenches;* Lorenzo D. Gilman, Troy, New York; dated July 19, 1855; original patent dated March 27, 1855.

Claim.—"Adding the tube with the nut surrounding the rod of the movable jaw to the arrangement of the adjustable toothed plate with springs, the toothed shank, and the eccentric with its strap attached to the toothed plate."

2. For an *Improvement in Fire Arms;* Frederick Newbury, Albany, New York; dated July 31, 1855; original patent March 20, 1855.

Claim.—"The construction and arrangement of the hammer and trigger with their parts as substitutes for the sear lever and tumbler. Also, the ratchet action plate with its cam slot as a substitute for the ratchet lever and ratchet pawl. Also, the cylinder spring stop lever as fitted and applied as a substitute for the united actions of the click lever and stop catch lever. Also, the combination of the hammer, trigger, ratchet action and cylinder spring stop lever to operate jointly in the process of firing. Also, the apparatus for detaching and re-attaching the barrel to the stock, viz: the bent lever lying in a recess within a metal projection from the barrel, with its catch at its back end, fitted to hold into a notch in the stock and kept in place by a spring lying within the said recess, in combination with the hinge plate, this arrangement being a substitute for the thumb connecting plate."

Re-Issues for July, 1855.

1. For an *Improvement in Machinery for Felting Hat Bodies;* William Fuzzard, Charlestown, Massachusetts; dated July 10, 1855; original patent dated January 13, 1855.

Claim.—"Giving the felting action by means of the moving apron to receive the article or articles to be felted within the fold thereof, and there confined and compressed by the rollers, or their equivalent, acting on the apron."

2. For an *Improvement in Corn Planters;* Samuel Malone, Tremont, Illinois; dated July 10, 1855; original patent dated January 3, 1855.

Claim.—"The peculiar construction of the horizontal slide made reversible from end to end for the purpose of varying the quantity of seed planted."

3. For an *Improved Portable Grinding Mill;* Lyman Scott, St. Louis, Missouri; dated July 10, 1855; original patent dated May 16, 1854.

Claim.—"The alternate deep and shallow sections of furrows upon the main grinding surface of the burr, for the purpose of distributing the material over said surface and preventing a surfeit or clogging upon any one point of said grinding surface. Also, the method of supporting the shell and adjusting the burr therein by means of the lower bridge-tree, grooved legs, sockets, and adjusting screw rods, when said legs served the double purpose of supports to the shell and guides to the bridge-tree. Also, the arrangement of driver, arms, burr, and shell, constructed so, that the several operations of breaking the ear, cracking the cob, and grinding into meal, may be all conducted without straining the mill or power applied."

4. For an *Endless Chain Horse Power;* George Westinghouse, Central Bridge, New York; dated July 19, 1855; original patent dated June 13, 1854.

Claim.—"The construction and attachment of the gearing, having a hub or pinion permanently affixed on the ends of each shaft, to either of which the centre caps or hubs of either the driving or band wheels fit and are fastened."

5. For an *Improvement in Cotton Presses;* Cyrus J. Fay, North Lincoln, Maine; dated July 17, 1855; original patent dated January 31, 1854.

Claim.—"1st, The use of the slats or guide strips. 2d, The tenons upon the transverse bars of the doors, which, entering mortises in the frame work, relieve the hinges from the strain which would otherwise come upon them. 3d, Hinging the doors of the press to prevent them from violently bursting open when the bar which confines them is removed."

6. For an *Improvement in Machinery for Dressing Treenails;* Delia A. Fitzgerald, Assignee of Jesse Fitzgerald through Josiah Pierce, City of New York; dated July 17, 1855; original patent dated August 28, 1849.

Claim.—"The use of the cutters in combination with the enlarging and heading apparatus, or apparatus analogous thereto, and this, whether any one or more of the parts of the enlarging and heading apparatus, or apparatus analogous thereto, are used separately or collectively in combination with the said cutters, whereby treenails are cut and shaped by the use of such mechanical devices."

7. For an *Improvement in Looms for Weaving Figured Fabrics;* Richard Garsed, Frankford, Pennsylvania; dated July 24, 1855; original patent dated November 6, 1849.

Claim.—"Operating the headle frames by the application of a cylinder having two or more patterns interchangeable at pleasure. 2d, The employment of two or more distinct patterns simultaneously in the same loom interchangeable at pleasure. Also, the apparatus for turning the cylinder, whereby it can be moved through a great or less space, as may be required."

DESIGNS FOR JULY, 1855.

1. For *Cooking Stoves;* Russell Mann, Troy, N. Y., Assignor to G. W. Eddy, Waterford, New York; dated July 3, 1855.

Claim.—"The ornamental design and configuration of stove plates."

2. For *Spoons;* Henry Hebbard and John Polhemus, City of New York; dated July 3, 1855.

Claim.—"The use and arrangement of the ornamental devices for ornamenting the front of the spoon and back of the spoon, or either of them, in combination with the spoon or other similar article of table cutlery."

3. For *Franklin Fire Places;* Nathaniel P. Richardson, Portland, Maine, dated July 31, 1855.

Claim.—"The ornamental design of the stove and particularly that of each of the members."

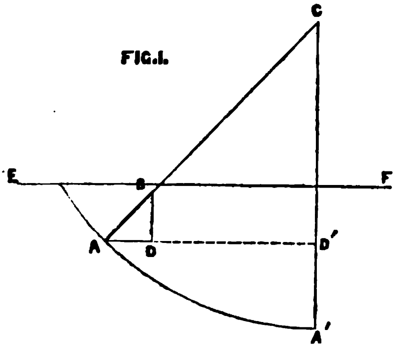
MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Remarks on the Relative Efficiency of the "Common Radial" and the "Feathering" Wheels.

It is generally admitted that the total loss of effect, or power, in the common radial wheel, is the sum of the losses of the oblique action of the paddles on the water and the slip. The former is calculated by taking the mean of the squares of the sines of the angles of incidence at which the paddles strike the water, or, which is the same thing, the mean of the squares of the cosines of the angles of the arm and water; for one angle is the complement of the other. This will appear plain from an inspection of figure 1. A C is the arm making any angle at C, with the vertical line, C A′; A B the breadth of the paddles, and E F the surface of the water. Now, it is manifest that, inasmuch as the vessel is moving in a horizontal direction, the line B D, at right angle to that direction, represents the only portion of the paddle, A B, that is efficient in propelling the vessel, and the line, A D, represents that portion of the paddle that tends to lift the vessel out of the water, which, consequently, as it produces no propulsive effect, must be entirely lost. But the line, A B, being the breadth of the paddle, represents the force applied to it, which is divided into two other forces, A D, which tending to lift the vessel, is the loss, and B D, at right angle to the vessel's path, is the efficient force, or the portion that is utilized in propelling the vessel. The two together, however, cannot exceed the total force applied, viz: A B; and, by the nature of right

FIG. I.



angled triangles, the sum of the squares of A D and B D are equal to the square of A B, and A B representing the power applied—which we will consider unity—the square of B D will be the square of the natural sine of the angle B A D, and the square of A D, the square of the natural sine of the angle A B D. But the triangles A B D, A C D′, being similar, the angles at B and C are equal, and the loss of effect is therefore simply represented by the square of the sine of the angle that the oblique arm makes with the vertical one, but as the angle is continually changing as the arm moves through the water, we have to take the mean, and the more numerous therefore the divisions are made, the nearer correct will be the result.

Thus: supposing, as per figure 2, a wheel of 26 feet diameter, 6 feet immersion of lower edge of paddles, and 20 inches breadth of paddles, the loss from oblique action is calculated as follows, the arc being divided into divisions of 5° each, which are considered sufficiently numerous for practical purposes:—

	Angles of incidence.	Sines of the angles of incidence.	
½	55	·81915.	·33550 = half of the square of sine.
1	50	·76604	·58681 = square of sine.
1	45	·70711	·50000 = "
1	40	·64279	·41317 = "
1	35	·57358	·32899 = "
1	30	·50000	·25000 = "
1	25	·42262	·17860 = "
1	20	·34202	·11697 = "
1	15	·25882	·06698 = "
1	10	·17365	·03015 = "
1	5	·08716	·00759 = "
1	0	·00000	·00000 = "
1	5	·08716	·00759 = "
1	10	·17365	·03015 = "
1	15	·25882	·06698 = "
1	20	·34202	·11697 = "
1	25	·42262	·17860 = "
1	30	·50000	·25000 = "
1	35	·57358	·32899 = "
1	40	·64279	·41317 = "
1	45	·70711	·50000 = "
1	50	·76604	·58681 = "
½	55	·81915	·33550 = half of the square of sine.
22			5·62952

As 22 : 5·62952 : : 100 : 25·588 per cent. of the power applied to the wheels.

Half of the square of the sine at the angle of 55° is taken, because the paddle in that position is only half immersed, consequently only half the power can be expended on it as if entirely immersed; and the angles are put down twice because the losses are the same after the arm leaves the vertical position as before it reaches it. The effect in the former case being expended in forcing the water downwards, and in the latter case in lifting the water, neither of which assists in propelling the vessel, the only tendency being to lift the bow and depress the stern.

The loss from slip is usually considered the difference between the velocity of the centre of pressure of the paddles and the velocity of the vessel.

Thus, if the velocity of the centre of pressure of the paddles exceed the velocity of the vessel by 18 per cent. of its speed, 18 per cent. is considered the loss of effect from slip. This, we conceive, to be an error. The 18 per cent. is the difference between the velocity of the wheel and the velocity of the vessel, nothing more, and therefore simply represents the slip in per cent. of the speed of the wheel, but not the *loss* of effect from slip. For it has been shown, that the loss resulting from the oblique action of the paddles on the water is as the squares of the sines of the angles of incidence, and if we suppose the wheel to be immersed to its axis, the loss from this cause on the paddle when in the horizontal position—the angle being 90°—is 100 per cent., and if the loss from slip of 18 per cent. be added to that, we have a total loss of 118 per cent., or more than the power applied. A positive absurdity. Or, again, supposing the vessel to be made fast to the wharf, the difference between the velocity of the paddles and the velocity of the vessel will be 100 per cent., and as the loss from oblique cannot, from this circumstance, be any less than if the vessel was going ahead, there will be a total loss of the power applied to the wheels of 125·588 per cent.

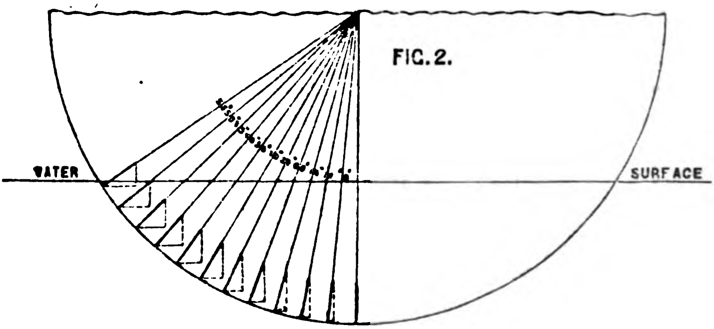


FIG. 2.

At the angle of 45° it has been seen that only one-half of the area of the paddle is effective in propelling the vessel, and the other half is lost in oblique action. Now, then, if 18 per cent. is the loss from slip when the whole area of the paddle is effective, as it is in the vertical position, when only half the area is effective, the contents of the column of water driven aft in the same time can be only half, consequently requires only half the power to do it, and the loss therefore in that position cannot exceed half of 18, or 9 per cent.; at the angle of 30°, where three-quarters of the paddle is effective, the loss is ¾ of 18 = 13·5 per cent. Thus we see the loss from slip goes on decreasing from the vertical to the horizontal position, at which place it becomes nothing. We can, therefore, approximate very nearly to the true loss, in the present radial wheel, by taking the mean of these losses at the angles as laid down in figure 2. They are as follows:—

At 0° = 18— ·0000 = . 18· per cent.
" 5 = 18— ·1866 = . . 17·8634 "
" 10 = 18— ·5427 = . 17·4573 "
" 15 = 18— 1·2056 = . . 16·7944 "
" 20 = 18— 2·1055 = . 15·8945 "
" 25 = 18— 3·2148 = . . 14·7852 "
" 30 = 18— 4·5000 = . 13·5000 "
" 35 = 18— 5·9218 = . . 12·0782 "
" 40 = 18— 7·4371 = . 10·5629 "
" 45 = 18— 9·0000 = . . 9·0000 "
" 50 = 18—10·5626 = . 7·4374 "
" 55 = 18—12·0780 = . . 2·9610 "

2 . 138·3343
2

Doubled for both sides of the vertical position, 276·6686
18·

294·6686

$$\frac{294{\cdot}6686}{22} = 13{\cdot}394 \text{ per cent. of the power applied to the wheel.}$$

The same result is obtained as follows:—

100·000 (power applied)—25·588 (oblique action) × 18 per cent. (slip of the vertical paddle) = 13·394 per cent.

We have, then, for a total loss in this radial wheel, 25·588 + 13·394 = 38·982 per cent. of the power applied to it.

Feathering Wheel.—Let us take a feathering wheel of the same diameter of centre of pressure, *i. e.* 26 ft. 4 in. in diameter from outside to outside of paddles—same immersion, breadth, and number of paddles, and see how it compares with this.

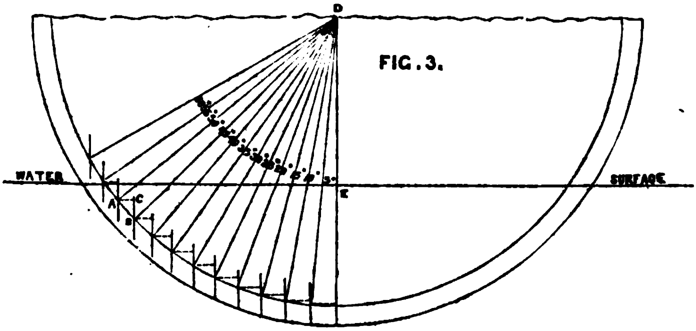


FIG. 3.

It is conceived by some, that the only losses in this kind of wheel are the friction of the eccentrics, &c., and the slip, but there is another loss, with deep immersions or light slips, occasioned by the *drag* of the paddles as they enter and leave the water. In figure 3, the paddles are supposed vertical from the time they enter until they leave the water, and the positions of the arm will be seen at the degrees there laid down. The perpendicular lines drawn across the arcs are intended to represent the breadth of the paddles. It is plain that while the axis of the paddle moves from A to B, it moves horizontally the distance A C, and vertically the distance C B, and, supposing the vessel to be moving with the same velocity as the paddle, it will travel the distance A B, while the paddle travels horizontally the distance A C. Now, the distance A C, being less than A B, the paddle, in this position, cannot be giving out any power, but must be keeping the vessel back, by carrying a column of water in front of it, the base of which is equal to the area of the paddle, and length equal to the difference in lengths of the two lines.

If A B be represented by unity, A C will be represented by the natural sine of the angle A B C, and if the arc be supposed to be divided into an infinite number of parts, or composed of an infinite number of straight lines, A B will be at right angle to A D, and by consequence, the angle A B C, will be equal to the D A E, and as the sine of B, represents the distance traveled horizontally by the paddle, the sine of A must manifestly represent the same thing, but the sine of A is the cosine of D, which therefore represents the horizontal velocity of the paddle at the angle of 50°, its circular velocity being 1. The difference between these two lines is, therefore, the loss from *drag*, supposing there to be no slip; but as all paddle wheels must have some *slip* when they are propelling a vessel, the line A B diminished by the amount of slip will represent the distance traveled by the vessel, and the loss from drag will therefore, instead of being the difference between A B and A C, be the difference between a fraction of A B and the whole of A C, dependent upon the amount of slip. If this fraction of A B be just equal to A C, the loss from drag in that position becomes 0; for though the paddle be giving out no power to the vessel, it occasions no resistance to the vessel's progress through the water, because it is moving horizontally precisely as fast as the vessel itself; and if the fraction be less than A C, the resistance will, of course, be on the after instead of the forward side of the paddle, and it must, in consequence, necessarily, be assisting in propelling the vessel.

Now, then, from the above, it must be evident to any one, that so long as the paddle, after it enters the water, is moving horizontally at a less rate than the vessel, it cannot be giving out any power, but must be an actual resistance to the vessel's progress through the water. Taking figure 3, and giving the wheel the same mean loss from slip as the radial wheel, viz: 13·394 per cent., we will ascertain the loss from slip at the different angles there laid down, and attend to the drag afterwards, which is merely slip in the opposite direction, or what might be termed *negative* slip.

To give this wheel the same mean loss from slip as the radial wheel, it has to have on the arm when in the vertical position or

Cosines.

At 0° . . . 26·225 per cent.
" 5 = ·99,619—·73,775 = . . 25·844 "
" 10 = ·98,481—·73,775 = . . 24·706 "
" 15 = ·96,593—·73,775 = . . 22·818 "
" 20 = ·93,969—·73,775 = . . 20·194 "
" 25 = ·90,631—·73,775 = . . 16·856 "
" 30 = ·86,603—·73,775 = . . 12·828 "
" 35 = ·81,915—·73,775 = . . 8·140 "
" 40 = ·76,604—·73,775 = . . 2·829 "
" 45 = . . . 0·000 "
" 50 = ... 0·000 "
" 55 = . . . 0·000 "

134·215
2

Doubled for both sides of the vertical position, 268·430
26·225

294·655

$\frac{294·655}{22}$ = 13·394 per cent. of the power applied to the wheel lost by slip. At the angle of 55°, the paddle is ·445 part immersed, but, being so near, we have taken it at a half for simplicity, and for like reason have considered the paddle at 50° entirely immersed.

It will be seen from the above, that the paddle, from the time it enters the water until after it passes 45°, is traveling horizontally at a less rate than the vessel, and the same effect ensues as it rises out of the water; there must, therefore, be a loss from drag or negative slip. Let us see what this amounts to.

Cosines.

At 55° = $\frac{·73,775—·57,358}{2}$ = 8·208 per cent.
" 50 = ·73,775—·64,279 = 9·496 "
" 45 = ·73,775—·70,711 = 3·064 "

20·768
2

Doubled for entering and leaving, 41·536

$\frac{41·536}{22}$ = 1·933 per cent.

We have then, for a total loss in this wheel, slip (13·394 per cent.) + drag (1·933 per cent.)=15·327 per cent. of the power applied to it.

The total loss in the radial wheel having been shown to be 38·982 per cent. and in the feathering wheel 15·327 per cent., we have 23·655 per cent. in favor of the feathering wheel. But of the whole power applied to the engines, about 20 per cent. is expended in overcoming friction of do., friction of load on working journals, working air and feed pumps with their load, &c., consequently, only 80 per cent. reaches the wheels, and 23·655 per cent. of 80 per cent. equals 18·924 per cent. of the total power applied to the engines in favor of the feathering wheel.

To stand off against this, we have the friction of the eccentrics, &c., (an amount that, perhaps, can only be estimated,) extra weight and wear and tear of wheels.

It will be seen, also, from the above, that the difference between the velocity of the feathering wheel and the vessel being 26·225 per cent. of the speed of the wheel, and the difference between the velocity of the radial wheel and the vessel being 18 per cent. of its speed, it follows that, making the same number of revolutions, the speeds of the vessels will be as 73·775 to 82, or as 1·00 to 1·11, consequently, the speed of the feathering wheel will have to exceed the speed of the radial wheel 11 per cent. to give the vessels the same velocity, but this speed of the wheel is as shown—consequent upon there being less resistance to the paddles—attained by an expenditure of 18·924 per cent. less power.

Centre of Pressure.—The centre of pressure of a rectangular plane immersed in a fluid, the upper extremity of which is even with the surface of the fluid, is $\frac{1}{3}$d from the bottom; but, inasmuch as the pressure is as the depth, when its upper extremity is below the surface of the fluid, this law no longer holds good. To ascertain the centre of pressure in this case, Jamieson on Fluids gives the following practical rule:

> "Divide the difference of the cubes of the extremities of the given plane below the surface of the fluid by the difference of their squares, and two-thirds of the quotient will give the distance of the centre of pressure below the surface, from which subtract the depth of the upper extremity, and the remainder will show the point in the centre line of the plane in which the centre of pressure is situated."

This rule can be applied directly to the feathering wheel by taking the mean immersion of the paddles as they move through the water, and assuming figure 3 to be of the same diameter from outside to outside of paddles, as figure 2, viz: 26 feet, we find the mean immersion of the lower edge of the paddles after their upper extremity gets below the surface to be

$$\left(\frac{29{\cdot}23+37{\cdot}84+45{\cdot}59+52{\cdot}44+58{\cdot}32+63{\cdot}09+67{\cdot}02+69{\cdot}78+71{\cdot}44}{19}\right)$$

$2+72=55{\cdot}87$ inches, and upper edge 35·87 inches.

The mean centre of pressure of the paddles, then, in these positions, is $\left(\frac{55{\cdot}87^3-35{\cdot}87^3}{55{\cdot}87^2-35{\cdot}87^2}\right)\frac{2}{3}-35{\cdot}87=46{\cdot}59-35{\cdot}87=10{\cdot}72$ inches from top, or 9.28 inches from bottom, and the mean centre of pressure from the time the paddle enters until it leaves the water $=\frac{9{\cdot}28\times19+(6{\cdot}62+3{\cdot}25)2}{23}=$ 8·52 inches from the bottom.

In the radial wheel, however, as the outer extremity of the paddle moves more rapidly than inner extremity, and as the resistance is as the square of the velocity, the centre of pressure must be considerably nearer the outer extremity on this account. One-third from the bottom, in this case, is therefore, probably, not much out of the truth, but as a portion of the paddle only, part of the time is immersed, we take the mean of the third of that portion and a third of the whole breadth of the paddle during the time it is entirely immersed. Thus, $\frac{(20\div3)21+(10\div3)2}{23}=$ 6·37 inches from bottom, showing the centre of pressure under these circumstances to be $(8{\cdot}56-6{\cdot}37=)$ 2·15 inches nearer the lower edge of the paddle in the radial wheel than it is in the feathering wheel. K.

For the Journal of the Franklin Institute.

Performance of the U. S. Steam Frigate "Powhatan."

Much has been recently said and written on the failures and inefficient performances of steamers belonging to the U. S. Navy, and it has been carried to such extent in some instances as to leave the impression that all the steamers of the Navy are abortions, without taking into consideration the difference of construction, size of masts, spars, &c., between a man-of-war as now constructed, and a merchant vessel, and the facility a steamer of the latter class has for repairs, compared with a man-of-war on a foreign station. Leaving, however, the causes of the failures or success of the steamers of the Navy to be assigned by those most interested, it may not be amiss, under existing circumstances, to make a few remarks on one, the "*Powhatan*," that has proved herself to be the swiftest, if not the most superior man-of-war steamer afloat, and for this purpose, we select her run between Shanghai and Hong Kong, China, on the 28th, 29th, 30th November, and 1st December, 1854, as showing the mean of her performance under sail and steam combined, but as a simple statement of her performance would be nearly useless without the dimensions of the ship and engines, we insert the principal ones as follows:

HULL.—

Length of keel,	246 feet.	
" " between perpendiculars,	250 "	
" " at load line,	250 "	
" " on deck,	251 "	6 inches.
" " from billet to taffrail, (extreme,)	276 "	6 "
Breadth of beam (moulded,)	44 "	
" " over guards,	69 "	6 "
Depth of hold,	26 "	6 "
Tonnage,	2419 32-95.	
Area of immersed midship section at load line,	675 sq. feet.	
Draft of water at load line,	18 feet	6 inches.
Mean draft of water aft during the above passage,	18 "	4 "
" " forward " "	17 "	2 "
Depth of keel below planking,	1 "	6 "
Displacement of hull at load line,	3535 tons (2240 lbs.)	
" " per inch "	22·9 "	

Hull built of live oak and copper fastened. Launching draft, 11 feet 4 inches=1600 tons including 18 inches of keel. Barque rigged, but the wheel houses prevent the main-sail from being set, and it is, therefore, never bent.

ENGINES.—Direct acting.—

Two inclined cylinders set at an angle of 30° 15′ with the keelsons.

Diameter of each,	70 inches.	
Stroke of piston,	10 feet.	
Diameter of wheels,	31 "	
Number of arms in each wheel,	28 "	
Single paddles: length of ditto,	10 "	
Depth of "	2 "	2 inches.
Mean immersion of lower edge of paddles during the above passage,	4 "	8 "

Condensers, 95 cubic feet in each.

Air-pumps, vertical—52½ ins. diam. by 42 ins.; stroke of piston,=51·8 cub. ft. in each.

Feed pumps, 8 ins. diam. by 42 inches; stroke of plunger=2111 cubic ins. in each.

The "*Powhatan*" hove anchor at Woosung, a few miles below Shanghai, 6·30 A. M., the 28th November, and at 5 P. M., December 1st, made Ly-u-moon Passage; received a pilot on board, and at 6·30 anchored in Hong Kong harbor, making a total time, including difference of time between the two places, 84¼ hours from the time the anchor was hove until let go. The speed of the ship appears, however, from the ship's log book, to have been logged only from 4 P. M., the 28th, to 2 P. M., the 1st, but as this constitutes the principal part of the passage, it will be sufficient for our present calculations. The following is an abstract of the steam log:

Time.	Knots per hour (per chip log.).	Revolutions of engines per minute (per counter.)	Pressure of steam above the atmosphere (per steam gauge.)	Vacuum in condensers.	Point of cutting off from commencement of stroke.	Throttles.	Coal.	Ashes and clinker.	Sea.	Wind.
			lbs.	ins.	ins.		lbs.	lbs.		
From 4 P. M. Nov. 28, to midnight,	10·406	12·57	10·9	26	34	Wide open.	32,800	4,290	Light abeam,	Moderate breeze abeam.*
Nov. 29th,	9·979	12·4	11·1	26	29·5		91,575	10,296	Moderate on the quarter,	Fresh top-gallant breeze on the quarter.†
" 30th,	10·708	13·74	11·1	26	28·5		98,750	7,088	" "	Fresh top-gallant breeze nearly aft.‡
From midnight to 2 P. M. Dec. 1st,	11·428	14·41	12·1	26	25		75,800	5,427	" "	Moderate breeze on the quarter.§
			lbs.	ins.	ins.		per hour.	per cent.		
Means,	10·63	13·28	11·3	26	29·25	"	4,255	9·06		

* Fore and aft sails set.

† Sails furled from 4 to 10 A. M.; the remainder of the day fore and aft sails set; difference of time this day from running to westward, 15 minutes.

‡ Fore-sail and fore-topmast staysail set from midnight to 4 A. M.: at 9 A. M. set fore-topsail; at 11·30 A.M. set main-topsail; fore and main topsail and foresail set the remainder of the day.

§ Fore and main top-sails and foresail set.

From a number of indicator diagrams, the back pressure in the "*Powhatan*" cylinders is shown to be about 3·5 lbs. per sq. in. of piston, and the initial pressure 1·5 lbs. less than the pressure per steam gauge: we have, then, from the above abstract, neglecting clearance and using Marriotte's law for the expansion of steam, as 4·1 (number of times the steam is expanded): 2·411 (Hy^{c}. log.+1) : : 11·3+14·7—1·5 (initial pressure) : 14·77 lbs. mean pressure, and 14·77—3·5=11·27 lbs., mean unbalanced pressure per square inch of piston; and the power exerted by the engines

$$\left(\frac{11{\cdot}27\times3848{\cdot}4\times10\times13{\cdot}28\times2}{33{,}000}\times2=\right)698{\cdot}15 \text{ horses.}$$

The power required to work the air-pumps, independent of friction, from indicator diagrams, is ·7 lbs. per square inch of steam pistons, and allowing for working the feed pumps, it will be somewhat augmented, say to 1 lb.=8·87 per cent. of the total power of the engines, and allowing 15 per cent. for overcoming the friction of the engines with their load, there remains only 76·13 per cent. of the total power to be applied to the wheels. Let us see in what manner this is disposed of:

The circumference of the centre of pressure of the paddle boards, at the above immersion, is 93·6 feet, and using the number of feet given by Bowditch for a knot, we have the following for the slip of the wheels on the 28th:

$93{\cdot}6 \times 12{\cdot}57 \times 60 = 70593{\cdot}12 =$ feet traveled by centre of pressure of paddles per hour.

$6120 \times 10{\cdot}406 = 63684{\cdot}72 =$ feet traveled by the vessel per hour.

$\overline{6908{\cdot}40} =$ difference, which is 9·784 per cent. of the speed of the wheel.

The slips on the 29th, 30th, and 1st, calculated in the same manner, are 12·302, 15·073, 13·576 per cent. respectively, giving a mean for all four days, of 12·684 per cent.

The slips of a paddle wheel is the difference between thevelocity of the centre of pressure of the paddles and the velocity of the vessel; and the loss from slip is this difference in per cents. of the speed of the paddles, multiplied, not into the total power applied to the wheels, but into the portion that remains after the loss from the oblique action of the paddles is deducted. Thus, in the present case, the power applied to the wheels being considered 100, and as the loss from oblique action at the above immersion is 15·085 per cent. the loss from slip is $\overline{(100-15{\cdot}085} \times 12{\cdot}684 =)$ 10·77 per cent. of the power applied to the wheels; giving a total loss for slip plus oblique action of $(10{\cdot}77 + 15.085 =)$ 25·855 per cent. But as only 76.13 per cent. of the whole power exerted by the engines reaches the wheels, we have 25·855 per cent. of 76·13 per cent. = 19.683 per cent. of the total power of the engines for the sum of the losses of the wheels, leaving 56·447 per cent. = 394 horses to be utilized in propelling the vessel.

Boilers.—Four copper boilers of the double return ascending flue *variety*, containing 8500 square feet of fire and flue surface, and 2300 cubic feet of steam room.

Length of flues including steam chimney 49 feet, grate surface 354 sq. feet, which has been reduced to 300 square feet by building brick bridge walls in the backs of the furnaces; proportion of grate to heating surface 1·00 to 28·33; coal consumed the hour per square foot of grate, 14·18 lbs.; water carried in the boilers at a density of $1\frac{3}{4}$ per Sewell's "Salinometers." The quantity of water evaporated per pound of coal, neglecting losses from radiation and leakage of the valves, we obtain as follows:—number of cubic feet of steam used per stroke, from the above abstract, including clearance of piston and space between the valves and cylinder = 77·7, at a pressure of $(11{\cdot}3 + 14{\cdot}7 - 1{\cdot}5 =)$ 24·5 lbs. per square inch, and the number of cubic feet used per hour in both cylinders $= 77{\cdot}7 \times 13{\cdot}28 \times 60 \times 2 = 247645{\cdot}44$. The relative volumes of steam and water, at this pressure are as 1064 to 1; we have then $\frac{247645{\cdot}44}{1064} = 232{\cdot}749$ cubic feet of water evaporated per hour, and considering a cubic foot of sea water to weigh 64·3 lbs., we have 232·749×64·3=14965·76 lbs. of water evaporated per hour with 4255 lbs. of coal=3·5 lbs. of water per pound of coal.

The temperature of the water in the hot well averaged 107° Fah. and the sum of sensible and latent heat of steam at (11·3+14·7=) 26 lbs. per square inch, from the latest reliable experiments, is 1187·5° Fah. and the sensible heat alone 240° Fah. Carrying the water in the boilers at 1¾, that is, 1¾ lb. salt in 32 lbs. of water, and considering the sea water to contain 1 lb. of salt in 32 lbs. of water, we find the loss from blowing off thus:

Heat required to raise the feed water from 107° to 240° Fah. = 133°.
" " evaporate the water from 107° Fah.=1187·5—107=1080·5°.

Now, then, since the water was maintained at a density of 1¾, one part that entered the boilers was blown out and the remaining ¾ part converted into steam, hence:—

$133 \div \overline{1080{\cdot}5\times\frac{3}{4}+133} = 14{\cdot}1$ per cent. of the total amount of fuel consumed in the furnaces; consequently the remaining 85·9 per cent. is that which evaporated the 3·5 lbs. of water, the 100 per cent. therefore, evaporates 4·07 lbs. of water per pound of coal.

This is an exceedingly low evaporation, and is about 2½ lbs. less than is obtained from the same boilers with good anthracite coal. The bunkers being nearly empty, in the present instance, the coal consumed was in consequence, the scrapings, composed principally of very fine and dry bituminous, mixed with considerable dirt and fine anthracite. The rapid draft occasioned, therefore, much of it to be drawn through the flues and lodged in the connexions, which accounts for its showing only 9.06 per cent. of ashes and clinker.

It is probable also, the steam valves leaked to some extent, which has reduced the apparent evaporation somewhat.

From the above abstract it also appears, that the slip of the wheels with the fore and aft sails set, and a moderate breeze abeam, was less than when the square sails were set with a fresh breeze nearly aft, and a moderate breeze on the quarter. It is probable, therefore, from this, that the speed of the vessel was over-logged on the 28th, but as the slip on the 30th and 1st, is very nearly what it would have been with no sail at all, it is also probable that she was under-logged on those days, rendering the mean speed, therefore, not beyond the truth.

With an unlimited supply of good coal, with the above immersion, under steam alone in smooth water, an average of 17 revolutions per minute can be attained without any difficulty for any length of time, and allowing 18 per cent. for slip, we have a speed of

$$\left(\frac{93{\cdot}6\times17\times60\times{\cdot}82}{6120}=\right)12{\cdot}8 \text{ knots per hour,}$$

which may be considered her maximum performance without the assistance of sails. K.

For the Journal of the Franklin Institute.

Particulars of the Steamer Lebanon.

Hull and Machinery built by James & George Thompson, Glasgow. Intended service, New York to Liverpool.

HULL.—			
Length on deck from fore part of stem to after part of stern post, above the spar deck,		252 feet	6 inches.
Breadth of beam at midship section,		30 "	5 "
Draft of water at load line,		17 "	
" " below pressure and revolutions,		17 "	
Tonnage of hull independent of engine-room,	817·62		
Contents of bunkers in tons of coal,	400		
Masts and rig,	Barque.		
ENGINES.—Oscillating, placed fore and aft.—			
Diameter of cylinder,			54 inches.
Length of stroke,		5 feet.	
Maximum pressure of steam in pounds,	15		
Cut off,	$\frac{1}{8}$		
Maximum revolutions per minute,	$24\frac{1}{2}$		
BOILERS.—Two—Tubular.			
Description of coal,	Bituminous.		
Draft,	Natural.		
Consumption of coal per hour,	27 pounds.		
PROPELLER.—			
Diameter of screw,		12 feet.	10 inches.
Pitch of screw,	240		
Number of blades,	3		
Geared,	$2\frac{1}{8}$ to 1		

Remarks.—Frame of wrought iron $\frac{7}{8}$ to $\frac{5}{8}$ thick. Floors (Z L) *molded*, 5 inches;—*sided*, $\frac{5}{8}$ inches;—distance of frames *apart at centres*, 15, 16, and 17 inches. Has four water-tight bulkheads. Keelson of $\frac{5}{8}$ plate, 32 inches deep.

H.

For the Journal of the Franklin Institute.

Description of Joslyn's Double Acting Pump. By H. HOWSON, C. E.

The annexed engraving, represents a sectional elevation of a double acting pump for which a patent was granted to B. F. Joslyn, of Worcester, Massachusetts, in April last.

In designing this pump, the object of the inventor has been to maintain the flow of water to and from the barrel, in as direct a line as possible, and to avoid the tortuous passages which usually occur in double acting pumps, and which present such serious impediments to their efficient working.

In Joslyn's pump the barrel A, is a plain tube of brass maintained in its proper vertical position by the top and bottom of the air vessel J. The top of the barrel fits into an annular groove in the cover K, and the bottom, in a similar groove cut for the purpose in the flanched valve seat F.

The yielding substance of the packing, used in attaching both cover and seat to the air vessel J, allows the barrel A, to be bound tight between the two.

B is the pump piston or bucket, composed of two metal disks, with leather packing between, and turned up on their edges in the usual manner.

Into the bucket is screwed the suction tube C, above the orifice of which, and on the top of the bucket, is a valve opening upwards. The tube C, is carried down so far that its end may, as the pump operates, be always submerged in the reservoir below.

D is the pump rod, connected to the bucket B by the arched piece G, which is of such a form as to allow the valve on the bucket to work freely.

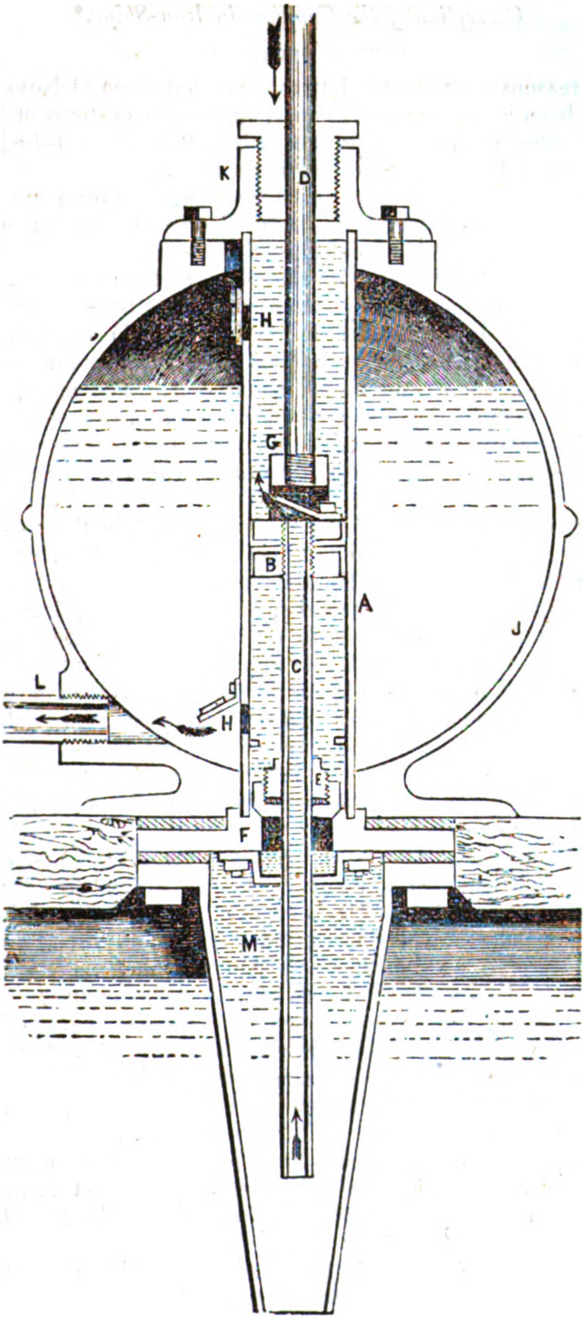
The rod passes through the stuffing box on the cover K, and is connected above to any suitable handle or other conveniently driving apparatus. E is a valve composed of two pieces, one screwed into the other with a light packing substance between, and through this valve passes the tube C easily enough to allow the valve to work with freedom, the packing at the same time preventing any leakage. The valve E, is prevented from rising too high by projections on the inside of the barrel, and the tube C, is guided by a guard under the seat F. The barrel is furnished with upper and lower discharge valves H, and the air vessel with the discharge pipe L. M is the main suction pipe with flanches on the top to secure it to the under side of the air vessel, the same fastening serving for the valve seat F.

On the descent of the bucket B, as shown in the engraving, the suction valve E, and upper discharge valve H are closed, and the water in the barrel below the piston is forced through to the lower discharge valve, into the air vessel, and through the pipe L, to its destination; at the same time the water from the reservoir rises in the tube C, passes through the bucket valve, and fills the space above.

On the upward motion of the bucket, the lower discharge valve H, is closed, and the valve E, opened, while the bucket valve being closed, and the upper discharge valve open, the water above the bucket is forced through the latter into the air vessel, and through the pipe L, at the same time a fresh supply of water is admitted through the main suction pipe M, and valve E, to the space below the bucket preparatory to being again discharged on the descent of the piston.

The simple method of securing the barrel, which is a plain brass tube, inside the air vessel, together with the peculiar arrangement of suction tube and valves, renders the whole a double acting pump of most economical and durable construction, while the flow of water throughout being nearly in a direct line, a less degree of power is expended in operating the machine than is employed in other pumps, while the supply of water is more efficient and regular.

The whole apparatus is easily taken in pieces, and as easily repaired when out of order, which recommends it as a pump peculiarly adapted to agricultural purposes; it may with equal advantage be used in all cases where a simple and efficient pump is a desideratum.


K
D
H
G
B
A
J
C
L
H
E
F
M

*Correction of the Compass in Iron Ships.**

(Continued from page 120.)

For the reasons stated in my letter in the *Athenæum* of November 11, I have not been able until now to reply to the observations of Mr. Airy, "On the Correction of the Compass in Iron Ships," published October 28. Such reply I feel myself called upon to make, not merely because Mr. Airy's observations have reference throughout to my papers on corresponding topics, communicated to the British Association at its late meeting, in Liverpool, but rather because of the importance to commerce and humanity of the obtaining of safe or correct compass guidance in iron ships. The method of adjustment suggested by Mr. Airy being of such prevalent use in the mercantile navy, it is obviously of the highest possible consequence that the principles on which it is founded should be strictly sound; for if they be not sound—or, much more, if they be essentially erroneous—then danger may arise, and catastrophe in life and property may be expected to result from a confiding dependence by the navigator on a process of compass adjustment which must necessarily be delusive.

Now, the question at issue betwixt us is essentially this: —Mr. Airy contends for the soundness of the principles of his mode of compass adjustment; I for the converse. He believes it, if properly arranged, to be correct and safe; I aver that, however it may be arranged, it cannot be correct,—and, if relied on, must in many cases dangerously mislead. The question, being one of such vast importance, demands our best consideration, and should, if possible, be determined. Whilst the discussion of it, therefore, is sought to be carried on with due regard to those amenities which are the ornament and grace of scientific controversy, the question claims to be discussed with that full, free, and unrestrained reference to experience and truth, without which no positive useful conclusion could reasonably be expected.

The most convenient course, as appears to me, for this discussion will be, to take up the leading statements in the paper "On the Correction of the Compass," by which Mr. Airy's views are sought to be established, or mine controverted. And if these statements, in both forms, can be conclusively negatived, as to me it seems they can, then the determination of the question at issue should follow as a matter of course,

Let me, however, guard myself against the possible supposition that there is no measure of agreement betwixt us on this important question. On the contrary, with the commencing paragraph of section v, where inference is drawn from my experiments, I mainly agree, viz.:—"That the source of local disturbance and its laws are perfectly well known; that the disturbance can be neutralized by well known means to the greatest exactness; and that this neutralization is perfect during change of time and change of place, until the ship herself undergoes an organic change."

But here my accordance with the principles stated serves but little towards the support of any yet known process of compass correction. It only extends "*until* the ship herself undergoes an organic change;" and my persuasion is, as it will be my aim to prove, that the ship herself is *most* liable to undergo such change at any period of time, and, under the fitting circumstances, in any latitude or region. If this were not so, or if such organic changes were not likely to occur except at long intervals of time, or many years,—then the process of correction by Mr. Airy might have been as effectual in operation as it is elegant in conception. But the converse of this supposition will, if I mistake not, demonstratively appear in the discussion of the views or statements which we gather from the paper "On the Correction of the Compass in Iron Ships." The views of Mr. Airy comprised in the third section of the paper, it may be convenient, in the first place, to make the subject of inquiry.

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* From the London Athenæum, December, 1854.

I. *Whether the shocks of the sea on the iron plates of a ship have the quality of impact sufficient to render my experiments by percussion, &c. applicable for indicating the probable results in magnetic changes?*—The experiments of which Mr. Airy makes courteous notice,—which are described briefly under the record of the proceedings of the late meeting of the British Association in the *Athenæum* of October 7,—relate to the phenomena, and the laws by which these are governed, as to magnetism developed in malleable iron by percussion or other mechanical action. The original discovery of the phenomena dates so far back as the year 1819, and the most characteristic results were communicated to the Royal Society of Edinburgh, first in 1820, and more fully in 1821, in an account of a new instrument, a *magnetometer*, and experiments made with it.—(*Trans. of Roy. Soc. of Edin.* Vol. ix. pp. 243-258.) Other papers, I may here add, in the *Philosophical Transactions* for 1822 and 1824, on the development of magnetical properties of iron and steel by percussion, extended the original process to more complete results.

By these experiments it was shown that the influences simply exerted by induction of the earth's magnetism on malleable iron were vastly augmented by mechanical action; and that this augmentation of magnetism became so far fixed in the iron as to remain as if permanent until acted on by fresh mechanical violence in some other relation to the direction of terrestrial polarity. This quality of magnetism it is, for which I subsequently proposed the name of *retentive magnetism.*

Similar phenomena, under the same laws—in the magnetizing *retentively*, neutralizing or inverting the polarity—were shown, in my earliest experiments, to result from any process of mechanical action, such as scouring, filing, bending, twisting, or from concussion by falling, or from a shock of electricity; and the same rule was subsequently found to apply to thick plates of rolled iron, and the plates actually cut out of the fabric of an iron ship. In any and all cases, wherever magnetism had been developed by mechanical violence, similar action served to control, change, neutralize, or invert the polarity, under appropriate changes in position.

An extract from an article which recently appeared in some of the Liverpool papers will well explain the decisiveness and precision of the results of mechanical violence on the iron employed in ship-building:

"Dr. Scoresby, who has extended his stay in Liverpool with a view to promoting inquiries into the means of remedying the inconvenience and occasional misguidance of the compasses in iron ships, visited, on Tuesday last, several of our building yards, having previously seen the Birkenhead yard of Mr. Laird. Accompanied by two or three gentlemen, who were witnesses of his experiments, he verified in a most remarkable and conclusive manner the deductions he had previously set forth at the meeting of the British Association at Oxford in 1847, and in his "Magnetical Investigations," published in 1852. In the yards of Messrs. Cato, Miller & Co., Messrs. Rennie, Johnson & Co., and Messrs. Vernon & Co., where several iron ships were in progress of construction, and from the proprietors of which he received every courtesy and attention, the magnetic action of the several ships on a delicate pocket compass, wherever they might be tried, was in exact agreement with his announcements before any trial was made. Thus, on approaching the bow of a ship, it was predicted that the south point of the compass would be attracted by the lower part of the stem, when, on making the experiment, the specified pole pointed directly to the part near which it was brought, so as, when the compass was carried from the starboard to the port side (round the foot of the stem), to make half a revolution of the needle. The like attraction of the north pole—the same being first notified—was as strikingly verified on ascending to the upper works of one of the ships, every portion of iron approached by the compass there showing strong southern polarity. A long slip of iron, picked up by Dr. Scoresby in one of the yards, was then made use of to test the principles he had elsewhere propounded respecting the terrestrially induced and retentive magnetism. Being struck a blow with a piece of wood (a wedge) in a suitable position, the iron slip was presented to the compass, whilst resting on a piece of timber, in a horizontal east and west position, where it exhibited no more influence than a piece of brass. The slip being raised up into a vertical position, the polarity of simple terrestrial induction was shown, which was reversed on reversing the iron. A blow with the wooden wedge, whilst the iron was held upright, elicited an intense energy of retentive magnetism, which was instantly reversed by striking the slip against a post the contrary way up, and finally neutralized by striking it again in a horizontal position. Again, a piece of old iron taken out of a ship was tested. It was part of an angle iron, or rib, belonging to the floor of a ship—of the shape, compressed, of the letter U. It was first placed with the ends on the ground and the convex edge upward (like a U the wrong way up), in an east and west line—the reverse of the position it occupied in the ship—and a single blow was struck against it with a large hammer. The original magnetism was instantly changed, and the ends resting on the ground, just according to theory, were found vigorously to attract the south pole of the needle, and repel the north. The angle-iron was then reversed, and the points held upward, in the position it had been fixed in when in use. One blow of the hammer reversed the polarity, and the upper ends of the U were found now to have energetic polarity attracting the north pole. The whole series of experiments, it may be added, were so striking and irresistibly conclusive, that they were looked upon by those present with unmixed admiration and surprise."

With these descriptions before him, the general reader will be enabled, I trust, to follow the course of reasoning by which I have endeavored to show that the positions taken by Mr. Airy are untenable.

Turning now to the views of Mr. Airy immediately before us, we find it admitted that causes exist tending to produce in iron ships effects like those exhibited in my experiments: but it is assumed that such causes are weak in efficiency and slow in operation. The latter article will come before us shortly.

Applying the principles elucidated by a large variety of experiments on various forms of iron, I had long ago predicted that changes—sudden and considerable they might be—would be liable to take place in the general or original distribution of a ship's magnetism by the mechanical violence to which the ship is exposed at sea from straining in gales of wind, blows from waves, or even the vibratory action of the engines of a steamer. But Mr. Airy's opinion seems opposed to the capability of such instrumentality being mechanically sufficient to produce any material effect.

As to strokes or shocks from the sea, Mr. Airy evidently underrates, and that in a measure that surprises one, the effective violence of the waves. His words are:—"We may speak poetically of the shocks which a ship receives from the waves; but in reality the plates of iron of which a ship is composed sustain no such shock. The direct effect of the most violent sea upon them is this: that in the course of two or three seconds of time, the plate is plunged five or six feet deeper in the water, and sustains the corresponding hydrostatic pressure. This is very different, indeed, from the raps and slaps in Dr. Scoresby's experiments, in which it is essential that the blow be of the nature of impact, occupying a very small fraction of a second of time."

These words of Mr. Airy I quote in full, because if there were no reasonable proportion betwixt the mechanical violence in my experiments (as here assumed) and that impressed on a ship by the sea, then the argument, on my part, of similar effects could not stand. But it will be easy to show, I believe, that both the conditions are mistaken; that the quantity of mechanical action requisite to produce magnetic change is over-estimated, and the mechanical violence of the sea's action singularly underrated.

The sort of blows of the nature of impact, assumed in the reference to my experiments to be needful for the effecting of magnetic changes in iron plates or bars, it should be noted, is but one out of various processes by which similar effects are produced. The variety of mechanical action in the experiments referred to, may be thus sketched:—I take, for example, a slip of thin sheet iron of fifteen to twenty inches in length, and when free from all magnetism give it, whilst held in an upright position, a *blow* with some hard substance. The magnetism of simple induction is, by the augmentation of the *retentive* quality, increased to four-fold. I take the same plate, again neutralized, and give it a *slap* with the hand in an upright position, and the magnetic action of the earth is again quadrupled. Again, when reduced to neutrality, I give it a slight *flexure*, not sufficient to change the figure of the plate, and the effect is pretty nearly the same. Or, finally, I produce in it a *vibratory tremor*, to represent the tremor in a steamer, and the magnetic result, if not quite so great, does not fall far short of it. Then, reversing the position of the plate when the retentive magnetism has been most fully developed—any one of the processes described is found sufficient, not only to change the magnetical condition, but to reverse the polarity!

These experiments show that, whatever may be the *measure* of effect of mechanical action in developing or changing the magnetism in iron, absolute violence of the nature of impact is not necessary, as the slightest flexure or mere tremor *may* produce a change.

The mistake, in the passage quoted, as to the nature of the action of waves on a ship, is almost too obvious, were not the inquiry before us of such great importance, to require any argument. The naval reader, indeed, will smile at the mechanical limitation of the action of waves of thirty to forty feet high, and rolling with a velocity of twenty to thirty miles an hour, (as I have had opportunity of proving,) to a mere change of a few feet of hydrostatic pressure. For every sailor well knows the fact, that ships are perpetually liable in hard gales of wind at sea to be struck and receive shocks sufficient to make the whole fabric stagger,—to cause every mast and yard to quiver in sympathy,—and, not rarely, to drive in bulwarks, and sometimes, in however rare cases, to start the very planks of a ship's upper works.

But a fact or two, as regards *iron* ships, should be conclusive in this matter,—both in respect to the powerful impact of waves, and their capability of producing organic changes in a ship's magnetism.

1. The *Great Britain*—whose adventures, in loss and recovery, form an article in the history of iron ships—when passing round, I believe, our own coasts, was struck by a sea with such violence as to indent a portion of the bow and start some of the iron plates, or the water-ways from the contiguous plates, and to raise up the deck above!

2. The *Ottawa*, Capt. Atkins, in crossing the Atlantic, from Quebec to Liverpool, in October last—being then on her *eighth* passage—was struck by a sea which damaged bulwarks, boats, &c., and caused a remarkable change, as Capt. Atkins informed me, in the compass—a change as a gentleman interested in the ship assured me, had been previously described to him as amounting to about two points!

These two incidents, both of them well known, may be left to speak for themselves.

II. *Whether any rapid or sudden alteration or organic change in a ship's magnetic condition is, to any appreciable extent, likely, if indeed possible?*—Not to risk a misinterpretation of Mr. Airy's views, I shall take leave to quote his own statements. Referring to the probability of a change in the compasses of the *Tayleur*, as had been asserted, in an angle of two points, he says:—"I unhesitatingly answer, it is not likely." * * "And I aver there is no known instance of such a change,—and I do not believe an instance can be produced of a rapid change of one-fourth or one-tenth part of this amount."

As these views take us to the essential question, in the matter of experience, I shall be excused in first quoting what I believe to be *facts* of experience.

It is somewhat difficult to deal with the opinion above expressed in the calamitous case of the *Tayleur*, because that opinion is in such positive and direct opposition to the evidence taken at the coronor's inquests; and to that taken by the Liverpool Local Marine Board, and to the Report of Captain Walker, Royal Navy, given in to the Board of Trade. All these sources of information go to *prove* this at least, that two *adjusted* compasses, which agreed, very nearly, on the ship's leaving port, were found to differ, to an extent of about two points, but two days afterwards. Changes, therefore, must have taken place in this ship's organic magnetism to produce in two compasses, previously agreeing, such a wide difference. But this, obviously, was but a part of the actual change. After passing Holyhead, on the morning of the fatal Saturday, the courses of the ship, as indicated by an adjusted compass, ranged, according to a variety of evidence, from west by south to south-west by south,—courses which should have led the ship well down the Channel. But, as indicated by Capt. Noble's own chart, which I now have before me, and by corrections suggested by intelligent and competent, but uninterested, persons at Liverpool, the entire change in these two compasses (as determined finally by the stranding on Lambay Island) must have extended to some two or three points in one, and four points, or more, in the other! And such a change as this, as we shall hereafter, I believe, see, is not out of range of probability on scientific grounds.

Sudden changes of an appreciable, and sometimes considerable, quantity in a ship's magnetism are shown in Vol. II. of my "Magnetical Investigations" (page 416) to be by no means infrequent. In the *Ripon*, from Alexandria to Southampton, in May, 1848, a sudden change is noted in the Captain's "compass observations," after the passing of Cape Finisterre, in these terms:—"This sudden alteration in the variation led us fifteen miles to the east of our course, so as to make Ushant on the port bow!" The sudden change in the case of the *Ottawa* is already before us. And numerous others might be adduced, if we were to take in here the cases of ships first rounding the Cape of Good Hope to the eastward. And, besides all this, the fact of a change, great and sudden, in the case of the *Tayleur*, stands on evidence, which, taken without preconception of theory or the prejudicing influence of particular personal views, could not be questioned.

III. *Whether, with reference to any such rapid or sudden change, as has been asserted of the Tayleur's compasses, we may assume, "speaking with our present knowledge of the subject, that it is not possible?"*—If I were to meet this opinion by the mere expression of a contrary one, it would obviously serve no useful end. But, by reference to unquestionable scientific principles, combined with actual experiments on iron ships, I hope to be able to do more—to prove, perhaps, that our *present knowledge* should indicate the very opposite view to that taken by Mr. Airy.

In "Magnetical Investigations," Vol. II., published in 1852, and in public lectures at the United Service Institution, &c., on the compasses in Iron Ships, delivered the same year, it was shown, that every ship's original magnetic distribution must have specific reference to her position whilst building; and that the vast power of retentive magnetism, necessarily developed by the mechanical violence of hammering and adjusting the plates and frames of the ship, must take the direction, proximately, of the earth's inductive action. Hence the axial line in the centre of the ship should be expected to pass through, or near to, the general centre of gravity of the body of iron, in the direction of the magnetic dip. On this theory, as illustrated by diagrams, it was shown, that a ship built with her head eastward should have her axial line leaning, at its upper extremity, to the starboard side; with her head westward, to the port side; northward, towards the stern; southward, towards the head. It would follow, of course, that the plane of the magnetic equator would likewise be correspondingly oblique, and lie at right angles (or so tend) to the axial direction. And it was inferred, that this extreme obliquity of the magnetic arrangement could not, on occasions of powerful mechanical violence with the ship's head in *new positions*, remain permanent. The *quantity* of the magnetism developed by mechanical action, it was evident, could undergo little or no change whilst the ship remained in or near the same magnetic latitude,—nor would the *upright* iron—constituting the largest proportion of the magnetic material—be liable to change in these regions; but the *horizontal* iron must be liable to have its polarity altered, and the polar axis of the ship must be liable to be changed. For mechanical violence or vibration, however it might be produced, would *tend*, with the ship's head in new directions, to shake down the *oblique* arrangements of the polar axis and the equatorial plane into a *vertical axis and horizontal equatorial plane.* Hence, unless the magnetic arrangement developed by mechanical violence could be supposed to be beyond the control of mechanical violence under new directions of terrestrial induction,—the conclusion on scientific principles was inevitable, that the ship's original organic magnetism must shift or change.

Having thus shown that the present state of our knowledge leads, on theoretic considerations, to the conclusion that a ship's original magnetic arrangement would change—a conclusion, indeed, which I sought to establish in a paper on this very subject at the Meeting of the British Association at Oxford, in 1847,—it will be my object to show next week the correctness of the theoretic deductions by actual facts of experiment on iron ships. WILLIAM SCORESBY.

Torquay, Dec. 4.

(To be Continued.)

Specification of the Patent granted to JAMES A. CUTTING, *of Boston, in the United States of America, Photographer, for an Improved Process of taking Photographic Pictures upon Glass, and also of Beautifying and Preserving the same.*—[Dated London, July 26, 1854.]*

This invention consists in an improved process of taking photographic pictures upon glass, and also of beautifying and preserving the same, which process I have styled "ambrotype." My improved process has reference to the art of taking pictures photographically on a film of collodion upon the surface of a sheet of glass, the collodion being suitably prepared for the purpose. By the use of the said process, the beauty and permanency of such pictures are greatly increased, and I have on this account styled the process "ambrotype," from the Greek word ambrotos, immortal.

The first part of my invention consists in the use of alcohol, for the purpose of depriving the gun-cotton, of which the collodion is made, of its moisture after it has been washed, to free it from the acids used in its manufacture.

It has been found that where gun-cotton has been exposed to the action of the atmosphere for the purpose of drying it, the sensitiveness of the collodion prepared from it is sensibly diminished. By the use of alcohol it may be deprived of its moisture after being washed, without exposure to the air, and without the consequent deterioration of its sensitiveness. This part of my process I conduct as follows:—So soon as the cotton has been sufficiently exposed to the acids and has been thoroughly washed, it is plunged into strong alcohol, which effectually deprives it of the water which it contains, without exposing it to the atmosphere for the purpose. From this alcohol it is taken immediately to the mixture in which it is to be dissolved for the purpose of forming the collodion. This mixture consists of ten parts of sulphuric ether and six of alcohol, or thereabouts. The collodion thus formed is allowed to remain until it has settled perfectly clear, which usually requires about twenty-four hours. It is then decanted, and to every pint is added eighty grains of iodide of potassium dissolved in alcohol. It is then well shaken, and thirty-two grains of refined gum camphor is added to each pint of the collodion, and after it has again settled it is fit for use. The object of the camphor is to increase the vigor and distinctiveness of delineation of the positive pictures, and particularly of the half tints. It also greatly increases the beauty of the picture, by giving a fineness of deposit not heretofore attained by any other means. The use of the gum camphor in the manner above described forms the second branch of my invention. The collodion is then applied to the surface of the glass in the following manner:—

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* From the Repertory of Patent Inventions, April, 1855.

The plate of glass being held horizontally, a portion of the collodion is poured upon it, and it is then inclined in different directions, so as to cause the collodion to flow over its whole surface, upon which it forms a colorless transparent film; the excess of collodion is then allowed to run off, and the glass, being still held horizontally, is inclined to one side and the other, until the collodion becomes partially thickened or set. When this has taken place, and before it is dry, it is rinsed in a solution of crystallized nitrate of silver, of a strength of forty grains to the ounce of water; the film is thus impregnated with iodide of silver, and after remaining in this bath a sufficient length of time for the ether to escape from the collodion, the plate is ready to be placed in the camera. After being exposed a sufficient length of time in the camera, it is taken to a dark room, where the latent picture is developed, by the application of a solution of protosulphite of iron, acetic acid, and nitric acid, in about the following proportions:—One quart of soft water, one ounce protosulphite of iron, thirty-two drachms No. 8 acetic acid, one drachm nitric acid. These exact proportions are not rigid, but I have found them to be sufficient for the purpose of developing the picture. After this is accomplished it is washed in clean soft water, and then the remaining iodide of silver is dissolved from the collodion film by a solution of hyposulphite of soda, after which the picture is entirely cleansed of the hyposulphite solution by washing as before, in soft water.. The picture is then dried, either in the open air or by the aid of a gentle heat, and the process is completed.

To permanently improve the beauty of the pictures, and to deprive them of a bluish, hazy, indistinct look, is the object of my third improvement; which consists in the application of a coating of balsam of fir to the surface of the glass upon which the picture is made, the balsam being confined to the picture plate by a secondary plate of glass, which is applied to the picture plate in a manner which will now be described, and which hermetically seals up the picture and protects it from every and any injury not sufficient to fracture the glasses themselves. This part of the process will now be described.

A second plate of glass is prepared of the same size as that which carries the picture, and is thoroughly cleansed; the picture plate is then held horizontally, the picture side uppermost. The balsam is then applied in a line along one edge of the glass, and one edge of the secondary plate is then applied to the edge of the first, which contains the balsam. The two plates are then pressed gradually together, by which the balsam is caused to flow entirely across the picture towards the opposite edge, and the air is effectually excluded from between the plates. The superabundant balsam is then removed by pressing the glasses together, and a thin coating of it only is left upon the surface of the picture. The beauty and distinctness of the pictures are greatly enhanced by this application, the finer lines as well as the dark portions and shadows being rendered far more distinct, and the most minute delineations being brought out and made visible, while the application of the second plate of glass secures the whole from the action of air, moisture, and dust.

What I claim as my invention, is,

1st. The method of depriving the gun-cotton of its moisture by the use of alcohol, whereby the sensitiveness of the collodion prepared therefrom is preserved unimpaired.

2d. The use of gum camphor in the preparation of collodion for the purpose set forth.

3d. I am aware of the previous use of balsam for the purpose of cementing together lenses, and also of securing microscopic objects, and I therefore lay claim to no such use.

But what I do claim, is, the application of the balsam to the surface of photographic pictures upon glass, in combination with the method described of protecting and securing the same by means of the additional plate of glass.

*Compass Variation and Collisions at Sea.**

The following is an extract from a letter of Lieutenant Maury's, which was read before a meeting of the managers of the Life Saving Benevolent Association:

"NATIONAL OBSERVATORY, WASHINGTON, NOV. 7.

"Dear Sir,—I received, by due course of mail, your note with an account of the proceedings which took place before the British Association, concerning the errors of ships' compasses.

"There is a liability of the ships' compass to error, which none of the rules as yet laid down seem sufficient to detect, and it appears to have been an error from this source which led to the loss of the *Tayleur*.

"Magnetists have not been able to devise any plan for preventing or detecting these errors at all times. They can, however, be always detected when the sun or the stars are out, and in cloudy weather a close attention to the mariner's three L's, (log, lead, and look-out,) will go far towards preventing mischief.

"Every vessel, and especially those in the European and Californian trade, should be provided with an azimuth or standard compass; and whenever sights are taken for chronometer, observations should also be made for variation. For this purpose a place near the middle of the quarter of hurricane deck, and as far from any iron as possible, should be marked, and upon that spot the azimuth compass should always be placed when an azimuth or amplitude is to be taken; and on every such occasion the heading of the ship, both by the standard and the steering compass, should be noted, entered in the log, and allowance made according thereto for the courses steered by the binnacle or steering compass. The difference between these two compasses will be greater on some courses than on others. But most American navigators know the cause of this difference, how to detect it, and how to allow for it; and therefore it is unnecessary further to allude to the subject of 'Local Deviation.'

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* **From the Mechanics' Magazine, December 1854.**

"In addition to these precautions, a 'tell-tale' compass under the fore or maintop would be further removed than any of the compasses below, from the varying magnetism of the vessel, and I would recommend it especially for steamers, as a useful check. In case of no top, a place might be made especially for its accommodation aloft. I allude to dangers of deceitful compasses on Californian or European voyages especially, because vessels trading thither are so often enveloped in fogs as they near the land by the way; and because we have more steamers plying to those foggy ports than to any others. But what remedy can we provide against the liability to such dreadful disasters as that which befel the *Arctic?* The three L's do not constitute a sure preventive. I have reflected much upon the subject, and I like the ideas of my friend R. B. Forbes, of Boston, better than any I have heard. He proposes a double track across the Atlantic for steamers. By having one route for them to go, and another for them to come, we should not avoid entirely, but we should greatly lessen, the liability of collision. If steamers would agree to follow two such routes, I think I could lay them off so as to have them quite separate except at the two ends, without materially lengthening the passage either way."

Notice of Wood for Bearings of Moving Machinery.

John Penn, the well known steam engineer, of England, has lately patented the application of wood to bearings for propeller shafts. The inner surfaces of their bearings, being somewhat larger than the shafts, are grooved longitudinally to receive fillets of wood, lignum vitæ, or other hard wood preferred, the grain of which may either be parallel or perpendicular to the surface of the shaft. The grooves are dovetailed in section. The strips or fillets may be 1½ or 2 inches wide and project from the inner surface of the bearing ⅛ or ¼ of an inch; the spaces left between them serve to admit the water, which, it is desirable, should have constant access. Mr. Penn prefers to have the rubbing surface of the shafts of brass.

It is easily perceived that a number of spare fillets being provided, it is an easy affair to renew the bearing when it wears.

The same gentleman has also patented the application of wood to piston packing, stuffing box packing, and the faces of slide valves for steam engines; the usual metallic surfaces, according to this plan, are to be grooved out for the reception of the wood, which is held in by countersunk headed screws.

In the application of shaft bearings, the novelty is in the *mode* of using strips or fillets, which being cheap, readily changed, and admitting the water freely, would, no doubt, be an improvement, as it is known that wood and brass work well together, and that the wood surfaces become highly polished and produce little friction.

With regard to slide valves and pistons, the advantages do not appear to us so marked, as metallic surfaces operate well, and the use of wood would not lessen the expense, still it is an experiment worth trying.

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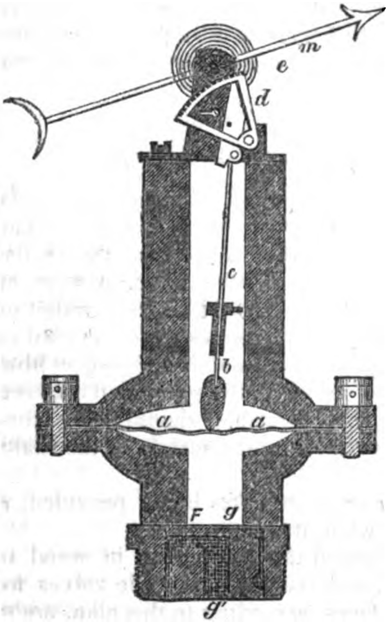
*Schæffer's Patent Steam Gauge.**

The accompanying engraving represents a steam pressure gauge, the merits of which have been spoken very highly of. A′ and A″ are two circular iron plates, between which is fastened by its outer part a steel plate, *a*, *a*, corrugated in circles, round its centre. By means of the jointed parts, *b*, *c*, any motion with which the plate, *a*, *a*, is effected, is transmitted to the rack and pinion, *d*, and thence to the needle or pointer.

The action of the instrument is as follows:—The steam enters through the opening, *g*, which forms a curved channel leading into the hollow, F, and presses upon *a*, *a*, which is covered on the underside by a tin foil covering, *k*, that serves to protect it from rust, and at the same time, to form the joint between A′ and A″. The curves of *a*, *a*, in consequence of their elasticity, are slightly raised by this pressure, and along with them, the parts, *b*, *c*, which transmit the motion to the rack and pinion, *d*, by a multiplication of about 400 times. On the pointer, *m*, is attached a small spiral spring, *e*, which merely serves to keep the rack and pinion, *d*, working on one side. By this arrangement the pressure which slightly moves *a*, *a*, is registered distinctly by the pointer on the dial. The opening, *g*, is preferred to be in a curved direction, for the sake of the steam condensing in going through it, and filling the under part, F, with water, which tends to keep the plate, *a*, *a*, at a low temperature.



The divisions on the dial are made by actual experiment. In order to point out the advantages possessed by this instrument, it has been remarked, that "the very slight motion which the plate, *a*, *a*, has to undergo, keeps it free from the chance of losing its elasticity; whereas, the very large multiplication makes the instrument, nevertheless, sensitive in the very highest degree, so that the slightest variation in pressure will show itself more distinctly. The simple contrivance, *b*, *c*, *d*, forming the transmission, and an entirely firm connexion between the plate and the pointer, keeps the instrument in a steady action without allowing any back-lash, or other motion of the pointer which is not caused by the actual pressure. The incasement is made so strong and solid, that no dust or any thing that might hinder the transmission in its action is allowed to enter, whereas, the plate, *a*, *a*, itself, forms a hermetical joint, preventing any thing entering beyond the hollow, F. Another consequence of the large multiplication adapted to this instrument is, that the pointer, by necessity, must return to zero after the pressure has subsided, so long as the plate has not lost its elasticity. By this means the pointer itself gives a control over the veracity of the instrument, as it is a matter of impossibility that the former could return to its starting place if the position of the plate was only to change by the breadth of a hair.

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* From the Mechanics' Magazine, December 1854.

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*On the Manufacture of Steel.**

(Continued from page 136.)

From this description of the process, it will be evident that pig iron will require a much longer time to decarbonize than the cakes of metal which have been roasted, as already described; and, again, it must be evident that a *purified* and *decarbonized* metal, such as I have proposed, must be the best to secure a good and equal quality to the steel, since the purified metal is more homogeneous than the crude iron.

When, therefore, care has been taken in melting down each portion of metal, and a complete and perfect layer of steel has been obtained after each successive melting, when the cinder has had due attention, so that it has been neither too thick nor too thin, and the heat of the fire regulated and modified during the progressive stages of the process, then a good result is obtained; a fine grained steel is produced, which draws under the hammer and hardens well. However good it may be, it possesses one great defect; it is this. During its manufacture, *iron* is produced along with the steel, and becomes so intimately mixed up with it, that it injures the otherwise good qualities of the steel; the iron becomes, as it were, interlaced throughout the mass, and thus destroys its hardening quality. When any tool or instrument is made from natural steel, without it has been very well refined, it will not receive a *permanent* cutting edge; the iron part of the mass, of course, not being hard, the tool cuts only upon the steel portion; the edge very soon, therefore, becomes destroyed. There is another defect in natural steel, but it is of less importance. When too much carbon has been left, the steel is raw and coarse, and it draws very imperfectly under the hammer; the articles manufactured from such steel often break in hardening; thus it is evident, that in producing the steel, every care, skill, and attention are required at the hands of the workman. These defects very materially affect the commercial value of the steel; the irregular quality secures no guarantee to the consumer that the tools shall be perfect, and, consequently, it is not used for the most important purposes; yet, where the raw steel is refined, it becomes a very useful metal, and is largely used in Westphalia for the manufacture of hardware, scythes, and even swords. It possesses a peculiarity of retaining its steel quality after repeated heating, arising from its carbon being, as it were, incoporated with *each* molecule of the mass. This property renders it very useful for mining and many other purposes.

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* From the Lond. Mechanics' Mag., May, 1855.

The raw steel, being so imperfect, is not considered so much an article of commerce with the manufacturer, but it is sold to the steel refiners, who submit it to a process of welding. The raw steel bloom is drawn into bars, one or two inches wide and half an inch thick, or less; a number of these are put together and welded; these bars are then thrown into water, and they are broken in smaller pieces to examine the fracture; those bars which are equally steelified, are mixed together. In manufacturing refined steel, the degree of hardness is selected to suit the kind of article which it is intended to make. A bar, two to three feet long, forms the top and bottom of the bundle, but the inside of the packet is filled with the small pieces of selected steel. This packet is then placed in a hollow fire, and carefully covered from time to time with pounded clay, to form a coat over the metal, and preserve it from the oxidizing influence of the blast. When it is at a full welding heat, it is placed under a hammer, and made as sound and homogeneous as possible; it is again cut, doubled together, and again welded. For very fine articles, the refining is increased by several doublings, but this is not carried at present to so great an extent as formerly, since cast steel is substituted, being in many cases cheaper.

I take the manufacture of puddled steel as next in order, because the product is similar to that of natural steel, that being obtained direct from the crude pig iron. It is a steel of very recent invention, and its manufacture is carried on entirely in Westphalia. But a few years ago a very small quantity of this steel was produced from *one* work. There are now several large establishments for its manufacture. The produce is becoming considerable, and likely to increase on account of its cheapness.

The object of the operation is similar to that adopted in the making of raw steel, to decarbonize pig iron down to that point at which it can be treated as steel. The process is this:—About 280 lbs. of pig iron are charged into a puddling furnace. As soon as this metal begins to melt, the damper is partly closed, and 12 to 16 shovelfuls of cinder, &c., as it comes from the hammer and rolls, are thrown into the furnace; the whole is then melted down together, and the mass is puddled with great care. The metal having become so far decarbonized as to lose its liquidity, the damper is opened, and 40 lbs. of pig iron are charged near the fire-bridge of the furnace. This is allowed gradually to melt and mix itself with the metal previously charged, which causes it to boil; a blue flame rises from the surface of the mass, and very shortly the metal stiffens. The damper is again three-quarters shut, and the mass is worked until it becomes waxy. The metal is then collected into balls and hammered into blooms. This steel is very imperfect; too much depends upon the manipulation of the process; it is out of the sight of the workman, and equally from under his control, being continually covered with cinder. Practice has, no doubt, assisted materially in the improvements made in the manufacture of this steel since its introduction, but it is evident that steel produced by such a process can only be serviceable for the commonest purposes, being subject to many serious imperfections. The blooms resulting from the process described are drawn, doubled, and welded precisely in the same manner as charcoal raw steel is refined; yet, such is the acknowledged inferiority of this steel, that whilst charcoal natural steel sells for £18 per ton, the puddled steel will not command more that £14 per ton, and an equal reduction is made on the refined steel manufactured from puddled steel blooms.

The next process is the Paal method, so called, from the name of the works at which the plan is used. These works belong to Prince Schwartzenberg, and are situated near to Murrau, in Styria. The process is based upon the old one of Vanaccio; it consists in plunging iron into a bath of melted metal. The carbon of the metal combines with the iron, and in a very short time converts it into steel. This process was carried further by Vanaccio, who contrived to add wrought iron to the metal until he had decarbonized it sufficiently; this was found to produce a steel, but unfit for general use. That produced by plunging iron into metal, was found to be very hard steel on the outside, but iron within; while that produced by adding iron to the metal was found too brittle to be drawn. The Paal method, however, as I saw it used at these works, is a decided improvement in the manufacture of refined natural steel. They produce natural steel at the Prince's various works, and bring it to Paal to be refined. The packets, as already described in the refinement of natural steel, are welded and drawn to a bar; whilst hot they are plunged into a bath of metal for a few minutes, by which the iron contained in the raw steel becomes carbonized, and thus a more regular steel is obtained than that produced by the common process. The operation requires great care, for if the bars of steel be left in the metal too long, they are more or less destroyed, or perhaps entirely melted. It commands a little higher price in the market, and is chiefly consumed by the home manufacturers, excepting a portion which is exported to Russia.

I have now described the manufacture of steel by various processes, in all of which the carbon is derived from the metal itself, and in which the whole of the molecules of the metal may be said to be equally charged; they contain the necessary amount of carbon, or steelifying principle, within themselves, and to this may be attributed the reason why, after repeated heating and hammering, the steel never loses its property of hardening. On this account, natural steel is used almost exclusively by the Mexican and South American miners for their tools.

I shall now turn to the second mode of producing steel, by introducing carbon into iron to such an extent as may be needful for the various purposes to which it is to be applied.

In explaining the theory and practice of manufacturing natural steel, I have shown that the object is to prevent the mass from becoming iron, the process being arrested at that point where the metal has lost so much of its carbon that the *remainder* is necessary for it to possess as a steel.

The process of converting iron into steel by cementation is the reverse of the process already described. The iron to be converted is placed in a furnace stratified with carbonaceous matter, and on heat being applied, the iron absorbs the carbon, and a new compound is thus formed.

When this process was discovered, is not known. At a very early period charcoal was found to harden iron, and make it a sharper cutting instrument; it seems probable that, from the hardening of small objects, bars of iron were afterwards submitted to the same process. To Reamur certainly belongs the merit of first bringing the process of conversion to any degree of perfection. His work contains a vast amount of information upon the theory of cementation; and although his investigations are in many instances not borne out by the practice of the present day, yet the *first* principles laid down by him are now the guide of the converter; our furnaces are much larger than those used by Reamur, and they are built so as to produce a more uniform and economical result; they give, however, precisely the same results which he obtained in his small ones.

A converting furnace consists simply of two troughs, built of fire-brick, 12 feet long, 3 feet wide, and 3 feet deep; the fire-room is placed between them, and the whole covered by an arched vault, so that the heat may pass entirely around these troughs, and distribute itself equally. The bar iron is placed within these troughs, stratum superstratum along with charcoal, which is broken to the size of beans. When the troughs are full, they are covered with sand or loam, which partially vitrifies and cakes together as the heat of the furnace increases, and thus, by hermetically sealing the top, the air is excluded. This furnace being charged with about 20 tons of iron, the fire is lighted, and in the course of 60 to 70 hours the iron will have become fully heated; *at this point the conversion commences.* The pores of the iron being opened by heat, the carbon is gradually absorbed by the mass of the bar, but the *carbonization* or conversion is effected, as it were, in layers. To explain the theory in the clearest manner, let me suppose a bar to be composed of a number of laminæ—the combination of the carbon with the iron is first effected on the surface, and gradually extends from one lamina to another, until the whole is carbonized. To effect this complete carbonization, the iron requires to be kept at a considerable uniform heat for a length of time. Thin bars of iron are much sooner converted than thick ones. Reamur states, in his experiments, that if a bar of iron $\frac{3}{18}$ths of an inch thick is converted in 6 hours, a bar $\frac{7}{18}$ths of an inch would require 36 hours to attain the same degree of hardness. The carbon introduces itself *successively*, the first lamina or surface of a bar combining with a portion of the carbon with which it is in contact, gives a portion of the carbon to the second lamina, at the same time taking up a fresh quantity of carbon from the charcoal; these successive combinations are continued until the whole thickness is converted; from which theory it is evident that, from the exterior to the centre, the dose of carbon becomes proportionately less. Steel so produced cannot be said to be perfect; it possesses in some degree the defect of natural steel, being more carbonized on the surface than at the centre of the bar. From this theory we perceive that steel made by cementation is different in its character from that produced directly from crude metal. In conversion the carbon is made successively to penetrate to the centre of the bar, whilst in the production of natural steel, the molecules of metal which compose the mass are *per se* charged with a certain per centage of carbon necessary for their steelification; not imbibed, but obtained by the decarbonization of the crude iron down to a point requisite to produce steel.

During the process of cementation, the introduction of the carbon disintegrates the molecules of the metal, and in the harder steel produces a distinct crystallization of a white silvery color. Wherever the iron is unsound or imperfectly manufactured, the surface of the steel becomes covered with blisters thrown up by the dilatation of the metal and introduction of carbon between those laminæ which are imperfectly melted. Reamur and others have attributed this phenomena to the presence of sulphur, various salts, or zinc, which dilate the metal; but this is incorrect, because we find that a bar of cast steel which is homogeneous and perfectly free from internal imperfections never blister, for although it receives the highest dose of carbon in the furnace, yet the surface is perfectly smooth. From this it is evident that the blisters are occasioned by imperfections in the iron. Iron increases, both in length and weight, during conversion. Hard iron increases *less* than soft. The augmentation in weight may be said to be $\frac{1}{200}$, and in length $\frac{1}{120}$ on an average.

The operation of conversion is extremely simple in its manipulation; nevertheless, it requires great care, and a long as well as a varied experience to enable a manager to produce every kind or temper required by consumers. Considerable knowledge is required to ascertain the nature of the irons to be converted, because all irons do not convert equally well under the same circumstances; some require a different treatment from others, and, again, one iron may require to be converted at a different degree of heat from another. The furnace must have continual care, and be kept air-tight so that the steel, when carbonized, may not again become oxidized. Generally speaking, in working converting furnaces, but little attention is paid to the theory of producing steel, which I have endeavored to explain. It is known amongst steel-makers, that if iron be brought in contact with carbon, and if heat be applied, it will become steel. This is the knowledge gleaned up by workmen, and, I may add, by too many owners of converting furnaces. The inconvenience arising from a want of care and knowledge of the peculiar state of the iron *during* its conversion, sometimes occasions great disappointment and loss. The success usually attained by workmen may, however, be attributable to an every-day attention to one object, thus gaining their knowledge from experience alone; good, I admit, in a workman, but this should not satisfy the principal or manager of a steel works. It is, perhaps, not needful that he should be a man of science, but I consider it the duty, as it certainly is the interest, of every owner of such works, not only to satisfy himself, but to be able to convince the minds of others, that he is fully conversant with the cause and effect of every operation in his business, and although a knowledge of chemistry may throw much light upon his operation, it is also necessary that he should possess a varied experience in conjunction with it, before he can pretend to produce steel of such superior and uniforn quality as the arts require. The conversion or carbonization of the iron, is the foundation of steel making, and, as such, may be considered as the first step in its manufacture. Before bar steel is used for manufacturing purposes it has to be heated, and hammered or rolled. Its principal uses are for files, agricultural implements, spades, shovels, wire, &c., and in very large quantities for coach springs.

Bar steel is also used for manufacturing shear steel. It is heated, drawn to lengths 3 feet long, then subjected to a welding heat, and some six or eight bars are welded together precisely as described in the refinement of natural steel; this is called single shear. It is further refined by doubling the bar, and submitting it to a second welding and hammering; the result is a clearer and more homogeneous steel. During the last seven years the manufacture of this steel has been limited, mechanics preferring a soft cast steel, which is much superior when properly manufactured, and which can be very easily welded to iron.

The price of bar steel varies according to the price of the iron from which it is made, but, as a general average, its price in commerce may be taken at £5 per ton beyond the price of iron from which it is made. Bar steel produced from the better irons is usually dearer than the commoner kind, on account of their scarcity.

Shear steel in ordinary size sells at £60 per ton nett.

Coach spring steel from foreign iron, £22 per ton nett.

Coach spring steel from English iron, £18 per ton nett.

These may be taken as approximate prices in 1854-5.

From the outline which I have given of the processes by which various steels are manufactured, it will be seen that there are in each great defects, want of uniformity, temper, or clearness of surface, unfitting them for many useful purposes. To obviate these defects, both bar converted and also raw steel are *melted*, by which the metal is freed from any deleterious matter which the iron might have contained; a uniform and homogeneous texture is obtained, whilst an equality in temper or degree of hardness is secured; besides which, the surface is capable of receiving a high, clear, and beautiful polish—qualities which the other steels I have described do not possess. The first steel which may be called cast steel is the celebrated wootz or India; it is produced by mixing rich iron ore with charcoal in small cups or crucibles. These are placed in a furnace, and a high heat is given by a blast. After a certain time this ore melts and receives a dose of carbon from the leaves and charcoal charged with it. The result is a small lump of metal with a radiated surface about the size of a small apple cut in two; it is very difficult to work; nevertheless, swords and other steel implements are manufactured from it in the East; it is not found in England as an article of commerce. The melting of bar steel was first practically carried out by Mr. Huntsman, of Attercliffe, near Sheffield, whose son yet carries on its manufacture, for which he enjoys a very high celebrity, by making use of the best materials, and insisting upon the most careful manipulation of his steel in every process. The manufacture of cast steel is in itself a very simple process. Bar steel is broken into small pieces, which are put into a crucible, and are melted in a furnace about 18 inches square and 3 feet deep. The crucible is placed on a stand 3 inches thick, which is placed on the grate bars of the furnace. Coke is used as fuel, and an intense heat is obtained by having a chimney about 40 feet high. Although a very intense white heat is obtained, yet it requires 3½ hours to perfectly melt 30 lbs. of bar steel. When the steel is completely fluid, the crucible is drawn from the furnace, and the steel is poured into a cast iron mould. The result is an ingot of steel, which is subsequently heated and hammered, or rolled, according to the want of the manufacturers. Although I stated that the melting of cast steel is a simple process, yet, on the other hand, the manufacture of cast steel suitable for the *various wants* of those who consume it requires an extensive knowledge; a person who is capable of successfully conducting a manufactory, must make himself master of the treatment to which the steel in manufactures will be submitted by every person who consumes it. Cast steel is not only made of many degrees of hardness, but it is also made of different qualities; a steel maker has, therefore, to combine a very intimate knowledge of the exact intrinsic quality of the iron he uses, or that produced by a mixture of two or three kinds together; he has to secure as complete and as equal a degree of carbonization as possible, which can only be attained by possessing a perfect practical and theoretical knowledge of the process of converting; he has to know that the steel he uses is equal in hardness, in which, without much practice, he may easily be deceived; he must give his own instruction for its being carefully melted, and he must examine its fracture by breaking off the end of each ingot, and exercise his judgment whether or not proper care has been taken; besides all this knowledge and care, a steel maker has to adapt the *capabilities* of his steel to the *wants* and *requirements* of the consumers. There are a vast variety of defects in steel as usually manufactured; but there are a far greater number of instances in which steel is *not adapted* for the manufacture of the article for which it was expressly made. Cast steel may be manufactured for planing, boring, or turning tools; its defects may be, that the tools when made crack in the process of hardening, or that the tool whilst exceedingly strong in one part, will be found in another part utterly useless.

*Improvement in Puddling Iron.** By JAMES NASMYTH, Patricroft, Manchester, England. Patented May 4, 1854.

Patented in the United States. Merrick & Sons, Assignees, Philadelphia, Pa.

This invention relates to a process of puddling iron, whereby not only will the disengagement of the carbon from the molten metal be greatly expedited, but the quality of the iron will also be considerably improved. In carrying out this invention, the molten cast iron in the puddling or refining furnace is subjected to the action of a current or currents of steam, introduced, as nearly as practicable, to the lowest portion of the molten iron, and thence diffused upwards, so as not only mechanically to agitate the molten iron, and thereby keep exposing fresh surfaces of the iron to the oxygen contained in the atmosphere passing through the furnace, but also, when brought in contact with the incandescent iron, to be reduced to its elements, and yield oxygen, which will chemically combine with the carbon of the iron, as well as with the sulphur or other oxidizable substances of the iron with which it may come into contact and have affinity, and thereby deprive the iron of those impurities; whilst the other component of the steam, simultaneously liberated (namely, hydrogen), is free to combine with any sulphur present in the furnace, whether as an ingredient in the iron, or as a product of combustion of the fuel employed for heating the iron; and thus, substances very prejudicial to the quality of the iron will be removed or prevented from combining therewith; whilst, at the same time, the operation will be materially expedited.

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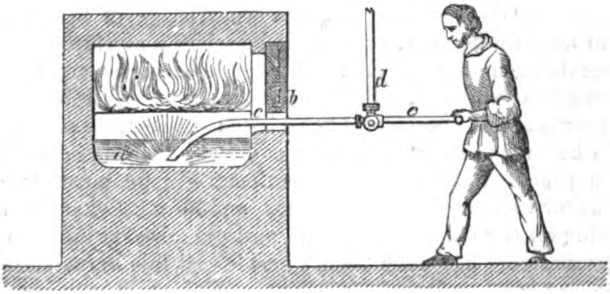
* From the Civil Engineer and Architect's Journal, April, 1855.

The engraving represents in cross section, an ordinary puddling furnace, suitably fitted for carrying on the puddling operation according to this invention. *a*, represents the molten metal in the basin of the furnace; *b*, the rabble-hole in the furnace door; and, *c*, a bent pipe, the forward end of which is admitted into the furnace through the rabble-hole, and which is shown of equal diameter throughout. This pipe *c*, is attached by a universal joint to a pendant-pipe *d*, in connexion with a steam-boiler, and is intended to conduct a current of steam beneath the surface of the molten metal. Affixed to the rear end of the pipe *c*, is a handle *e*, by means of which the attendant is enabled to direct the orifice of the pipe to any part of the bed of the furnace.



Claim.—Operating upon molten iron in the manner and for the purposes set forth.

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*Improvement in the Manufacture of Cast and Malleable Iron.**

Prof. Frederick Grace-Calvert, of Manchester, has patented an invention, the object of which is to obtain a better quality of cast and malleable iron from certain iron slags or cinders, known by the names of puddling, refinery, and heating slags or cinders, than is effected at the present day. The usual way of applying these slags or cinders on a blast furnace consists in adding them, either alone or mixed with ironstone, without submitting them to any previous preparation, except sometimes burning them in a heap. The consequence is, that as they descend in the furnace they are soon carried to a bright red heat and fused, and get mixed with the various materials which compose the charge of a blast furnace. A portion of these slags or cinders, falling on mine or coke, is not fluxed, and thus gradually finds its way to that part of the furnace where cast iron is being produced, and uniting with it, descends into the cupola or the blast furnace. It is easy to understand how the above iron slags or cinders, mixing themselves with the cast iron, injure its quality, for iron slags or cinders are chiefly composed of silicate, sulphuret, and phosphuret of iron, which act most injuriously on the quality of cast and malleable iron.

The mode of operating, so as to effect the complete fluxing of the above slags or cinders, and thus prevent the silica, sulphur, and phosphorus arriving in contact with the cast iron which is being produced, is as follows:—The first process consists in reducing the above puddling, refinery, and heating furnace slags or cinders into coarse powder, which is done by any of the ordinary mills and grinding apparatus now in use, and then adding to them about one-half their weight of slaked lime, made into a thick paste. They are then well mixed together, and the mass is made into lumps or bricks of a convenient size, which are dried or not, according to circumstances, previously to adding them at the top of the blast furnace; or the dried lumps of lime and slag or cinders may be calcined in a separate furnace, and afterwards introduced, with ordinary mine, at the top of the blast furnace; or the mass of lime and slag may be mixed with coal, coke, or charcoal, and calcined in a furnace, or introduced into crucibles, and thus separate the iron which it contains previously to its addition on the blast furnace. The patentee remarks, that heating slags or cinders generally, do not requir eroasting, but that refinery and puddling slags often do.

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*From the London Mining Journal, No. 1034.

The second process consists in roasting or oxidizing the iron slags or cinders before they are mixed with slaked lime. To oxidize these slags or cinders two different processes are adopted. The slags are reduced to fine powder, and introduced into an oxidizing furnace, such as is used for roasting copper ores; and whilst the powder is carried to a dull red heat it is well stirred, so as to transform the iron or the protoxide of iron it contains, into peroxide, the silicum into silica, the prosphurets into phosphates, and the sulphur into sulphurous acid. When the powder has assumed a bright red color, and no more sulphurous acid is produced, it is taken out of the furnace and mixed with slaked lime, and applied as above described.

The same purpose is attained by breaking the slags or cinders into small fragments, and introducing them with a small amount of coal into an ordinary kiln, or in one made of four walls which have numerous holes in the sides; the object of which is to admit freely the oxygen of the atmosphere, and which holes are also employed to remove the oxidized slags or cinders. These kilns are worked like ordinary limekilns—viz., the slags or cinders, mixed with a small quantity of coal, are constantly added at the top, whilst the oxidized slag or cinder is removed at the bottom by the opening or openings which exist there, and then the prepared slags or cinders are treated with slaked lime, as before described.

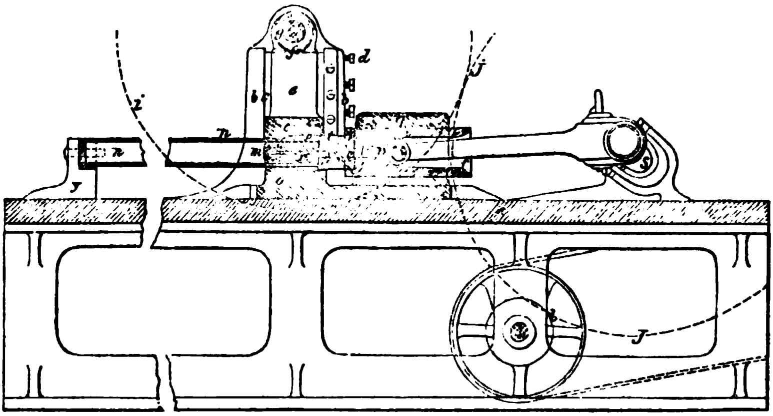
The third process to which the patentee submits puddling, refinery, or heating slags or cinders, is to reduce them into a powder, and introduce them into furnaces which communicate with the blast furnace by means of long flues, into which the volatile products given off from the mouths of the blast furnace or of the coke oven are passed. When the powdered slags or cinders are not sufficiently heated by the gases for these to act upon the component parts of the slags or cinders, a gentle heat is applied, so as to carry them to a dull red heat; then the silicates of protoxide of iron are decomposed, and metallic iron is produced. When the operation is completed, they are taken out and allowed to cool. Such reduced slags or cinders having been made into powder, are to be treated with slaked lime, in manner before described.

The patentee claims the use of hydrate of lime, or slaked lime, in combination or intimately mixed with heating, puddling, and refinery iron slags or cinders, both before and after calcining the latter.

Improvements in Strengthening the ends of Tubes to be attached to Boiler Plates, or to be used for other such Purposes. Patented by William Beckett Johnson, of Manchester, England.—[March 9th, 1854.]*

These improvements relate to a method of obtaining a thickened end or ends to tubes, whereby they may with greater security be attached to boiler plates or other apparatus to which metal tubular passages are required to be fixed. To effect this, the tube is manufactured by an ordinary method, and is compressed at the end or ends, so as to force a certain length into a smaller longitudinal space,—the consequence of which will be the desired increase of thickness.

The figure below shows, in longitudinal section, a machine constructed for this purpose. Upon a strong cast iron frame *a*, are formed upright parts, one of which is shown at *b*,—the other being at the opposite side, and removed, in order to show the parts in section. Upon these uprights are formed V-guides *c*, one to each standard,—being made adjustable by set screws *d*; and within them is situate a sliding-piece *e*, capable of being forced downward by a cam *f*, and carried upward by an eccentric *g*, situate within a sling formed upon the top of the sliding piece *e*. The cam *f*, and eccentric *g*, are both upon a shaft *h*, receiving rotary motion by the wheels *i*, *j*, the latter of which is driven from the main shaft *k*, by means of a pinion *l*. The sliding piece *e*, extends downwards to the dotted line *m*, and is of a semicircular interior form, so as to extend around one-half of the tube represented at *n*, under operation: the other half of the tube is in like manner surrounded by a



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* From the Journal of Arts and Sciences, May, 1855.

bottom die *o*, fixed to the stationary frame-work *a*, and both are chamfered out at *p*, so as to form a cavity corresponding in figure to the intended thickened end of the tube. Upon the frame-work *a*, is mounted a guide *q*, within which is situate a sliding piece *r*, caused to move to and fro by the action of a crank formed upon the shaft *s*. The sliding piece *r*, is continued by circular parts *t*, *u*, of two diameters, which are split in the direction of their length, so as to enable the part *u*, to be expanded or contracted as regards its diameter. Upon the guide *q*, are formed two projecting pieces *v*, *v*, carrying a cottar pin *w*, which passes through a rod *x*, situate within a circular recess formed in the parts *u*, *t*. The rod *x*, is slightly conical, being of larger diameter at its outward end, and will therefore, at that part, keep the split portion *u*, expanded. At one end of the machine are two projecting parts, one of which is shown at *y*; and between them, is a cross piece *z*, capable of being turned over on a centre pin, so as to leave the space between the two parts *y*, open. The operation of the machine is as follows:—According to the position shown in the figure, the end of the tube previously heated is about to be compressed into the recess *p*, for which purpose the slide *r*, will be caused to advance by the crank *s*, and will carry forward the part *t*,—during which movement the split mandril *u*, by sliding upon the conical rod *x*, will become expanded, and form an interior support for the tube. The die *e*, previously to this, will have been forced down by the cam *f*,—a dead run upon the periphery of which will retain it in that position, and, while forming the die for the intended thickened end, will serve to prevent a longitudinal motion of the tube: but this may further be secured by the cross piece *z*, the standards of which should be adjustable for different lengths of tube. The heated end having been forced into the dies by the advance of the part *t*, and caused to assume the shape of the dies at *p*, *p*, a smaller diameter of the cam *f*, will allow the top die *e*, to be raised by the action of the eccentric *g*: at the same time the crank *s*, will withdraw the mandril *u*, and cause it to slide back along the fixed rod *x*, and, as it passes on to a smaller diameter thereof, will contract, by reason of its split construction, so as to leave the tube free from interior pressure and enable it to be withdrawn: in order to do which, the cross bar *z*, is turned over upon its centre,—thereby leaving the space between the uprights *y*, free. The split mandril *u*, by now occupying a position upon a smaller diameter of the rod *x*, and being, therefore, of slightly less diameter than the tubes under operation, will enable the heated end of another to be applied and operated upon, as above described. As the rod *x*, does not partake of the sliding motion of the mandril *u*, *t*, the latter is hollowed out at *i*, for a sufficient distance for its reception, and a horizontal slit is also formed in it for the cottar *w*. The thickened end may be formed at one operation, or by repeated compressing operations in dies of gradually increasing dimensions, or by successive compressions in the same dies. The patentee remarks that he contemplates using the direct action of steam for pressing or "jumping up" the ends of the tubes. In reference to the purposes to which the improved tubes may be employed, he states that they will be found of advantage in all cases where such articles have to be united to plates, as in steam boilers, refrigerating or heating apparatus, &c., also where tubes have to be joined to each other with or without intervening sockets,—as gas-pipes, and steam or air-pipes.

The patentee claims the formation of a thickened end or ends to tubes by pressing or jumping up a portion of their length.

Arched Bulkheads for Iron Steamers.[*]

In the disasters which have happened to steamers during the past year, you cannot have failed to notice that the bulkheads, constituting the water-tight compartments, have usually burst at the very and only time when their services were needed. This may have led to a doubt as to whether they might be depended upon at all as a means of safety, in case the vessel should be stove and one of her compartments filled. But looking at their present system of construction, that is, a flat surface nearly unsupported in a fore and aft direction, it is a wonder that they have in any case been able to withstand the pressure of a column of water equal to the vessel's immersion when laden, increased by the filling of a compartment, aggravated, too, by the pitching motion of the vessel.

To make the bulkheads strong enough to withstand the pressure and motion of the water, I suggest that they should be shaped to the form of an arch, springing from the sides across the vessel. They may be made with either the convex or concave side towards the bow, but the former arrangement is to be preferred, as the vessel is most liable to receive injury forward, and the pressure of the water on that side cannot force the bulkhead out of shape.

March, 1855. KENNETH.

The New Iron Screw-Propeller Steam Transport-Vessel "Sovereign.[†]

Built and fitted by Messrs. Lawrie & Co., Iron Ship-builders and Engineers, White Inch, Glasgow, 1854.

DIMENSIONS.—			
Length on deck,		196 feet	·8
Breadth at two-fifths of midship depth,		24	·9
Depth of hold amidships,		18	·1
Length of engine room,		45	·3
" of shaft space,		67	·0
Breadth of "		1	·8
Depth of "		1	·9
TONNAGE.—			
Hull,		602	·24
Engine room,	220 ·95	222	·99
Shaft space,	2 ·04		
Register,		379	·25

Fitted with a pair of geared angular engines, of 100-horse nominal power: diameter of cylinders, 40 inches; length of stroke, 3 feet; having reversing gear. Screw propeller: diameter, 11 feet 6 inches; pitch, 11 feet 6 inches; two blades. One tubular boiler, fired fore and aft: length at roof, 17 feet 6 inches; ditto at furnaces, 16 feet; breadth, 10 feet 3 inches; depth, 9 feet 6 inches. Steam-chest: length, 12 feet 6 inches; breadth, 5 feet; depth, 5 feet 3 inches. Six furnaces, three at each end of boiler: length, 6 feet 6 inches; breadth, 2 feet 8 inches; depth 2 feet 11 inches. 230 cubic feet in steam-chest. 456 brass tubes, or 228 at each end of boiler; diameter, $2\frac{7}{8}$ inches, and 6 feet long. Chimney: diameter, 3 feet 6 inches, and 24 feet long. Contents of coal bunkers, 120 tons. Weight of engines, 70 tons; ditto of boiler and water, 30 tons; ditto of iron hull, 200 tons; ditto of wood, &c., 150 tons. Launching draft of water forward, 7 feet; ditto aft, 9 feet 10 inches; displacement, 450 tons. Stem, 6×2 inches; sternpost, 6×4 inches; frames, $4 \times 3 \times \frac{7}{16}$ inches, and 18 inches apart. Twelve strakes of plates from keel to gunwale, tapering in thickness from $\frac{5}{8}$ to $\frac{3}{8}$ of an inch. Launched on 14th January, with all the machinery on board. Trial-trip, February 5th, engines making 38 revolutions per minute; steam pressure 15 lbs. The speed of the vessel was 14 miles with tide, and $10\frac{1}{2}$ against ditto; draft of water forward, 9 feet 6 inches, and 11 feet 6 inches aft. Consumes 15 cwt. of coals per hour; has six bulkheads. Employed in the Black Sea, &c.; $604\frac{2}{9}\frac{3}{4}$ tons O.M.

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[*] From the Lond. Practical Mechanics' Journal, April, 1855.

[†] From the London Artizan, April, 1855.

Improvement in Screw Steam Machinery.[*]

A very simple but effectual plan has recently been introduced by Mr. Penn, the eminent engine maker, for preventing that constant and excessive wear and tear of the bearings on the shafts of screw steamers which has hitherto been found so great a practical difficulty and so continually recurring a source of expense. He introduces between the bearing and the shaft, thin slips of wood, which have the remarkable property of entirely suspending that incessant waste of material which, after a certain pressure on the square inch has been attained, is constantly in progress. This simple expedient has been adopted in the recent repairs of the *Himalaya*, and will probably be applied, if found successful in her case, to all screw steamers. While the surface of the bearing is preserved from waste, singularly enough the slips of wood show no indication of being rubbed away or heated.—*Nautical Standard.*

Notice of Colt's Revolver Factory.[†]

If we were to describe the factory (we can scarcely call it *manu*factory, the hand has so little to do in it), which Colonel Sam Colt has set up at Thames-bank for the production of "Revolvers," fully as it deserves, we should be led perhaps a little too far out of our more particular track: for a few memoranda, however, we *must* find room. It is so well ordered, so complete, so striking in its results, that all engaged in manufacture may learn something from it: it is itself one large machine, well oiled too, which takes in at one end a shapeless lump of iron and a piece of wood, and puts out at the other a beautifully finished arm, which you may load and fire six balls from separately in three-quarters of a minute, after a certain amount of practice. In each pistol there are fifty-three distinct pieces, including fourteen screws; and, for the formation of these, forty or forty-five separate machines co-operate—hammering, milling, cutting, drilling, punching, rifling, and shaving; all put into motion by a gallon of water "in a violent perspiration;" in other words, a 20-horse power steam engine. Some of the machines are especially beautiful: look at that for rifling and barrels, for example, with the brush to keep the cutters clean; and the one near it for drilling the six chambers around the central boring in the solid cylinder, where accuracy is so indispensable. That regular irregularity, the eccentric, plays an important part in this, as it does in the hammering machine below;—the machine patented by Ryder. Last week they turned out 525 perfect pistols here, and there are the means for making 800 or 900 a week, if it were necessary to do so.

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[*] From the Lond. Artizan, April, 1855. [†] From the Lond. Builder, March, 1855.

On the Injurious Effects of the Flickering of Gas-Lights.[*]

A correspondent, "C. W.," calls attention to the injurious effects of the flickering of gas-lights without chimney glasses on the eyesight of clerks in offices, many of whom, he has had opportunity of knowing, have had their sight so damaged, that, by the time they reach middle age, if much accustomed from youth to attentive fixture of the eye on white paper, under gas-light, they are unable to see or to write or read without spectacles. Public companies, boards, &c., as our correspondent remarks, ought to look to this.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, August 16th, 1855.

John Agnew, Vice President, in the Chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Letters were read from The Royal Geographical Society, and from the Commissioners of Patents, London.

Donations to the Library were received from The Royal Geographical Society; the Institute of Actuaries; the Chemical Society; the Statistical Society; and the Royal Institute of British Architects, London; Lieut. Colonel Baird Smith, Roorkee, India; Lieut. M. F. Maury, U. S. N., Washington City, D. C.; the Ohio Mechanics' Institute, Cincinnati, O.; S. D. Humphreys, City of New York; Ellwood Morris, Civ. Eng., Cold Spring, Pennsylvania; and H. Haupt, Civ. Eng., Philadelphia, Pa.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for July was read.

The Board of Managers and Standing Committees reported their minutes.

Candidates for membership in the Institute, (2,) were proposed, and the candidates proposed at the last meeting, (2,) were duly elected.

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[*] From the London, Builder, No. 634.

PALMER'S PATENT LEG.

This world renowned Artificial Limb, it will be recollected, was among the *few* signal triumphs of American ingenuity exhibited in the WORLD'S EXHIBITION in 1851. It there received the award of the GREAT PRIZE MEDAL, as the "*best*" limb (amongst thirty of the best English, French, and German manufacture) exhibited; and was so well appreciated, that an extensive manufactory is now in successful operation at 30 Regent Street, London, under the auspices of the Queen and the Medical Faculty of London and Paris.

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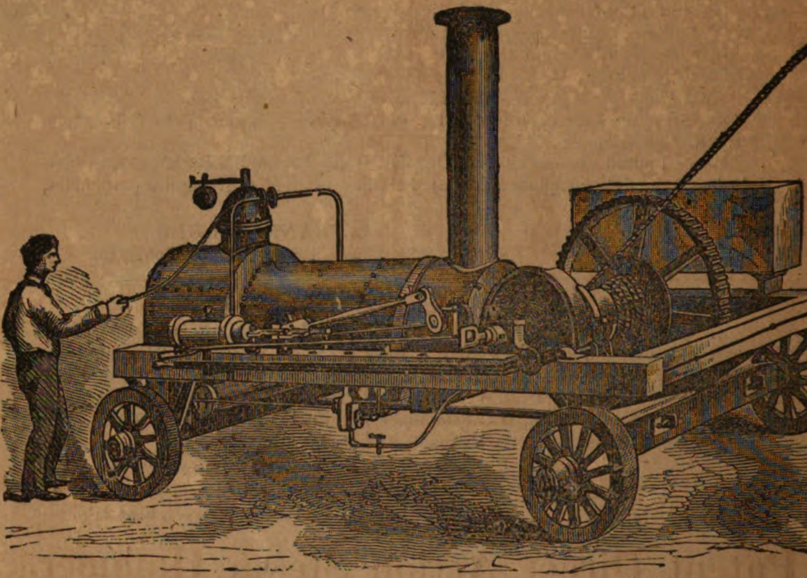

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power, in 1852, was afterwards purchased by the Schuylkill Navigation Compa
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months, as a substitute for the horse-power formerly used by him in driving his thre
ing machine. Another was constructed by order of Pierce Butler, Esq., to be e
ployed on the lands of the North American Coal Company. In 1853, a double cylin
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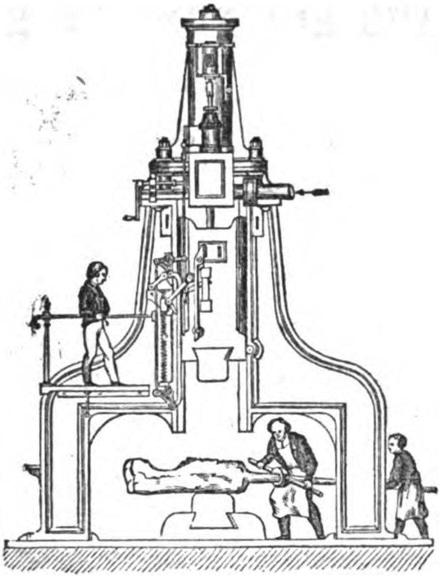

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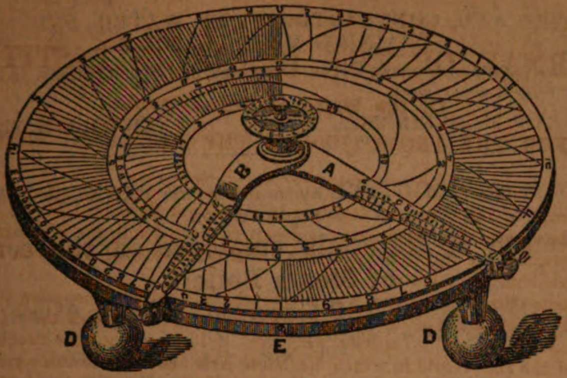

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JOURNAL

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THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

OCTOBER, 1855.

CIVIL ENGINEERING.

Canals and Railways in India. An abstract of paper read before the Royal Society of Arts. By W. Bridges Adams.*

In opening the discussion, Mr. Adams deprecated any exclusive leaning to canals or railways, other than for their respective advantages. It was desirable to enclose and cultivate India; and, for the purpose of cultivation, irrigable canals were desirable; but for the purpose of civilization, fast traveling was essential. To assert that no railway ought to be made where water transit exists in a similar direction, would be to determine on a great waste of very valuable time amongst the most intellectual members of the community—a process fatal to the general progress of the masses. In all times and ages, rapid transit—rapid as compared with the general movement of the community—has been found a necessity of government and progress. The ancient Peruvians, lacking the means of mechanical and animal locomotion, established a communication of human runners, at posts a few miles apart, in order to convey messages rapidly. Modern Indians are used as beasts of burden to convey their ruling classes at the rapid rate of four miles an hour, because they find it a necessity to travel faster than bullock-wagons, through districts where water transit exists not, and horses cannot be maintained. It might be said that people ought not to travel at a cost of cruelty, but they do, and they will, in failure of non-cruel methods; and amongst the national cruelties that have been abolished by the advent of railways, that of the cruelty to post-horses is not one of the least; a cruelty, be it remembered, not of the poor, but of the rich; a cruelty, not of the race-course or of the hunting-field, but of the road; a cruelty which the legislator, returning from his duties to his estate in the country, indulged in as prominently as other men, when giving an extra half-crown to the post-boy to induce him to give an extra spurring to the bleeding ribs of the jaded post-horse.

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* From the London Artizan, August, 1855.

Fast traveling must be, to induce civilization, even at the cost of stinted rations to the poor, who have to do the work at the outset, not destructive fast traveling for whims, but traveling as fast as can be accomplished without greatly enhanced cost.

A mechanical difference in the construction of the canal and the railway is this: the former must be a series of direct levels, with sudden drops, in the form of locks; whereas the latter may be a gradual incline. It is obvious that the incline does not increase the cost in making the line, whatever may be the case in working it. But locks and their maintenance do very seriously increase the cost both of making and working.

Canals belong to peculiar localities, such as Holland, where the water is in abundance, and it is almost needful to dig ditches to make dry land. In such districts a canal does not become a mischievous monopoly; but in England, which is by no means a dry climate, the canals were a monopoly, for there was only a given quantity of water, and it was all owned, and could not be increased by manufacture. That also might come to pass in India.

The railway came and beat down the monopoly. Iron is not limited like water; and wherever a railway proprietary charge large fares upon an extravagant capital or a spendthrift working expenditure, there, infallibly, in due time, will parallel lines of rail be laid down. The only way in which a practical railway monopoly could be accomplished in England, would be to purchase two strips of land, east and west, and north and south, in the form of a cross, and charge black-mail to every one passing over it, as the barons did in the olden time, when there were no Acts of Parliament to make individual advantage give way to the public good.

Rivers, to be constant, must be dependent on some process of nature for storing up water. In Chilé and Peru, the Andes perform the office by storing up the snow; but the rivers are little more than a hundred miles in length. In the Upper Ganges, the Himalaya range performs the same office. Mont Blanc and other mountain regions supply the Rhone, which was formerly a navigable river all the year round, while the snows were sheltered beneath the pine forests, and melted gradually. The pine forests being cut down, the Rhone is now an alternate mountain torrent and a non-navigable stream during great part of the year. The proof of this is, that within a few years past Lyons has been subject to periodical inundations, which have washed down dwellings and stores constructed of unburned bricks. It is obvious that such buildings would not have been erected if they had originally been in risk of melting down like barley-sugar. The large American lakes which are drained by the St. Lawrence, and to which the limestone range of Niagara forms a bar, are fed by the rains and melting snows; and it is stated that their depth is decreasing by the constant felling of timber to supply the numerous steamboats, which exposes the snow to melt, and the water to evaporate. In Ireland the great bogs form a kind of natural springs, from which the water gradually oozes to supply the rivers. Other rivers are supplied by mountain caverns with large inlets and small outlets. In countries of continuous rain, the rivers may be continuous without any of these resources.

Leaving the problematical question of navigable canals, we come to the question of irrigable canals. Of *their* value and permanent utility, if India is to make progress, there can be no doubt. Colonel Cotton cannot well overrate them in this particular. My own belief is that in proportion as irrigation extends, population will thicken, and that ultimately it will be found that the whole of the water can be advantageously absorbed to render the dry land fruitful. In hot countries, the roots of the plants appear to be the best absorbents. Rain is not favorable to ripening vegetation. But the process of irrigating land by open channels is a costly one. Along the channels there is a thick and tangled growth of weeds, requiring a constant expenditure of labor to keep down. In the beautiful plain of Valencia, in Spain, the whole water of the river falls short of the necessities of the cultivators, and leaves much good land useless, and generates a perennial strife amongst the peasantry, which rises into an occasional tumult, with loss of life, and has to be put down by the soldiery. There is a proverb about the water:—

"Una mitad al cielo,
Otra mitad al suelo."

"One-half to heaven,
The other half to earth."

Probably, of all the water that springs from the mountain, one-third is absorbed by the sun, and another third by the porous channel, to grow weeds, while only one-third reaches the cultivated land.

In hot Spanish countries, with irrigation, it is customary to plant the acequias or irrigation channels with trees, to prevent evaporation. But there is yet wanting a cheap and efficient mode of conducting irrigation water under ground; and when that takes place, it will be the most valuable gift that modern science can bestow on India, saving human labor, and preventing the waste of water. The water must be filtered before it enters the channels, to prevent deposit; and the channels must be easily accessible, to clear out obstacles. If Colonel Cotton will set himself to work to solve this problem, he will be a still greater benefactor to India than he has yet been.

One chief objection that Colonel Cotton makes to railways is, that by their cost and outlay they will prevent the canalization of the Indian rivers, which would be much cheaper per mile. Yet he says that navigable canals are insufficient, and proposes as an adjunct light railways, the cost of which he does not tell us, though he asserts that the ordinary lines will cost £10,000 per mile. Now, a railway consists essentially of permanent way and rolling stock. These are the two items which cannot be done without, any more than the bridges and levelling. All else, expensive stations, &c., is a question of choice. The permanent way and rolling stock will not exceed £3400 per mile; and earth-works and bridges, at

£1600 more, would only make up £5000 per mile. Horse railways, wholly of iron, to work into this as branches, could be constructed at between £500 and £600 per mile: and by a horse railway, I mean a very permanent horse railway, and not a toy—horse railways that can be laid down by unskilled Indian laborers, after being shown how the first pair of rails go together. I go still further. There are districts where even railways to track light wagons by hand would be desirable, as in Welsh slate-quarries; and they also should be constructed wholly of iron, for reasons obvious enough to those who have had to grub up thorny roots to boil their kettle.

I have for many years past been an advocate, in print and out of print, of light railways for steam power, of horse railways, and of portable railways. In the "*Times*" of January, 1850, and in the "*Spectator*" of February, 1850, these plans will be found favorably reviewed.*

The question of railways might be nearly an exact science, but it is far from that yet. Railways divide into two branches—tram-ways, or trammel-ways, in which the guiding power is on the rail, and railways proper, in which the guide is on the wheel. A commoner division is that of steam locomotion and animal locomotion, the structure varying with the loads to be borne. The railway is better than the trammel-way, for several reasons, as it keeps clearer from dirt and obstacles, and engenders less friction. The mechanical principles which should govern the construction are the same in all cases.

As the object of a railway is to lessen the obstructions to the movement of rolling wheels, we may consider the rail and wheel as man and wife, not to be treated apart; for as a bad wife may make a miserable husband, so a bad wheel may spoil a rail, or *vice versa.*

The first thing to desire in a railway is, that it should be as nearly as possible a horizontal plain, straight, and parallel between the rails.

2d. The rails should be virtually inflexible under the rolling loads. In making a girder bridge over a stream, it is necessary that the depth of the girder should bear such a proportion to the length and load, that it will not deflect in the opening. A rail is, or should be, a girder, likewise non-deflecting; and if the support below it be a yielding material, or solid discontinuous supports, the rail must be deep enough not to bend between the supports or upon the unfirm material, or the result will be a line constantly out of repair, needing what is called maintenance of way

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*"A pamphlet just published, entitled the 'Iron Ways,' will be read with satisfaction by proprietors of railway shares, for its hopeful anticipations of what may be effected towards a restoration of profits by the adoption of light and frequent trains. It also contains a number of suggestions on the general development of traffic, which, in point of ingenuity and completeness, as well as in the faith they exhibit in the extent to which the public would avail themselves of increased facilities, resemble the original Post-office plans of Mr. Rowland Hill."—From the "*Times*," Jan. 25th, 1850, Money Article.

"REDEMPTION OF THE RAILWAY SYSTEM.—The author shows how the railway world can be rescued from its difficulties, and how the extension of a more manageable railway system, by its minuter ramifications into the very farms, would reconcile farming with free trade, as it would make transit easy both for produce and locomotive farming apparatus, and would thus bring a full manufacturing power and activity into the heart of agriculture. But although the view is put forth by a practical man, its reasoning is so clear, and its method of attaining the proposed end is so direct, that railway folks will pronounce it unpractical."—From the "*Spectator*," Feb. 9th, 1850.

and increasing resistance to traction. The pressure ought to be equally distributed by absence of flexure, and this can only be done by depth.

3d. The rails should be laterally inflexible, or great friction will ensue by the rocking of the engine and carriages. They should be laterally straight, or a continuous sinuous movement will take place.

4th. The junctions of the rails should be so arranged that, while allowing for expansion and contraction, the strength of resistance, both vertically and laterally, should be as great at all the joints as at the intermediate portions.

5th. An efficient connexion should exist between the two opposite rails, to keep them parallel.

6th. The surface of the rails beneath the wheels should be so hard and tough, that they will neither crush nor laminate beneath the rolling loads.

7th. The bearing surface of the rails or supports on the ballast should be of such area that the rolling loads will not disturb it.

8th. The height of the wheel surface above the bearing surface on the ballast should be the minimum, while the bearing surface is the maximum.

9th. The rail should bed into the ground, to keep it steady laterally, and prevent rocking.

10th. The depth of the rail below the bearing surface of the ground should be so much in excess of the rise above the ground as to constitute a suspensive principle, in opposition to the principle of a prop, which is the common mode of structure. Where only light loads are required, the prop plan may be used for convenience; but it is not the form of greatest permanence.

11th. In maintaining the line of way, care must be taken to provide good drainage for wet weather, and easy means of watering in dry weather.

The construction of any railway, great or small, and its mechanical fitness, may be tested by these rules. Various modes of construction may be used, but all should be firm without loose jolting; and though timber sleepers have their advantages, no doubt greater permanence may be attained by an iron structure. Cast iron, if in sufficient masses, will do; but wrought iron is the best: and, to absorb mischievous vibration, loose timber blocks, analogous to wood paving, and not structural, may be applied as a portion of the ballast at a cheap rate.

(To be Continued.)

On Hydraulic Limes, Artificial Stones, and Different Novel Applications of Soluble Alkaline Silicates. By M. Fr. Kuhlman.*

Entrusted, about the close of the year 1840, with some trials relative to some abundant efflorescence, which was formed on a perfectly new building, and which was considered to be due to the formation of nitre, I was soon convinced that the efflorescent salts were formed to a great extent of carbonate of soda, and that the lime which had been used (hydraulic lime, from the neighborhood of Tournay,) was the cause of the efflorescence which had been observed. A closer examination soon taught me that all limes, and particularly hydraulic limes and natural cements, contained appreciable quantities of potash and soda.

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* From the Lond. Journal of the Society of Arts, July, 1855.

Theory of Hydraulic Limes.—In a work which I had the honor of presenting to the Academy, at a meeting held on the 5th of May, 1841, I endeavored to explain the part which potash and soda might play in stones and cements, and I admitted that these alkalies served to bring the silica to the lime, and thus to form silicates, which, by means of the application of water, solidified a portion of the mass, producing the formation of a hydrate, analagous to that which takes place with plaster. I have pointed out since then to the Academy numerous facts as the basis of this theory, and that, among others, of the immediate change from fat lime to hydraulic lime, by simply treating with a solution of silicate of potash. If, after the burning of the limestone, potash is in contact with silica, the silicate which is formed must necessarily re-act, and this can only take place as soon as the burnt lime is brought into contact with water.

I have greatly added to my experiments on this head, and I have established the fact that, with fat lime and silicate of potash, both of them pulverized and mixed in the proportion of 10 to 12 of silicate to 100 of lime, a lime can be obtained which shall have all the characteristics of hydraulic lime. If these substances are not well pulverized the re-action will be very incomplete, and an effect will subsequently be produced, bringing on disintegration. If from my former trials there results the possibility of converting a fat lime into an hydraulic mortar, by sprinkling it with a solution of an alkaline silicate, in my more recent trials I have found a means of producing at once with a vitreous silicate and lime, hydraulic cements of any required degree of strength This will enable us to form, at a reasonable expense, buildings to stand the action of water, in places where fat limes alone are now found. Powdered silicate of potash in some sort becomes an agent for producing this hydraulic property, of which future experiments will determine the value.

Artificial Stones.—Looking at the great affinity of lime for silica dissolved in potash, I was naturally led to examine the action of alkaline silicates on calcareous stones. Here I was still more fortunate, for the alkaline silicates became at once the means of a variety of applications of the highest utility. Let us look at what is said on this point in the *Comptes Rendus* of the Society's meetings.

"By mixing some powdered chalk in a solution of silicate of potash, a cement is obtained, which hardens slowly in the air, assuming a degree of stiffness, which, under certain circumstances, renders it applicable for the restoration of public monuments and the manufacture of moulded articles.

"Chalk, whether in an artificial paste or in its natural state, plunged into a solution of silicate of potash, takes up, even when cold, a quantity of silica, which may be increased considerably by exposing the chalk alternately to the action of the siliceous solution and the air. The chalk assumes a smooth appearance, a compact grain, and a color more or less yellow, according as it is more or less impregnated with iron.

"Stone thus prepared is susceptible of a high polish. The hardness, which is at first but superficial, penetrates by degrees into the centre, even where there is considerable thickness. It appears capable of becoming of incontestible utility in the formation of works of sculpture and ornaments of the most delicate workmanship; for when the silicifying process—"*silicatization*"—has been effected on well-dried chalk, without which good results are not possible, the surface remains unalterable.

"Some attempts made to render this stone applicable for lithography give promise of great success.

"This method of converting soft limestone into silicious limestone is likely to become a great acquisition in the art of building. Ornaments, unaffected by damp, and of great hardness, may thus be obtained at little cost; and, in many cases, a plaster made with a solution of silicate of potash will preserve from subsequent decay ancient monuments formed of soft limestone. This same plaster may become of general application in those countries where, as in Champagne, chalk forms almost the only building material."

I have shown experimentally that that one part of the silica from the silicate becomes separated by the action of the carbonic acid of the air, but that those parts of the silicate which have come into contact with a sufficient quantity of carbonate of lime pass into the state of silicate of lime. My work, presented to the Academy in 1841, pointed out numerous industrial purposes to which the impregnating of porous bodies of mineral substances might be applied, whether the objects operated upon were organic or inorganic. Considering these applications of the art as of the first importance in building, I have attempted to extend them, and I have just laid before the Academy a new series of observations.

Harmonizing the Shades of the Silicified Stone.—I have given the name of "*silicatization*" to this remarkable conversion of soft and porous limestone into siliceous and compact limestone. As the operation of this process to articles of sculpture and building materials gives rise to a coloring very frequently so marked as to render the joinings more apparent and the veins more distinct, I have been compelled to seek a remedy for this objection.

There are two essential and general points to be met. Chalk walls are too white, while some kinds of ferruginous limestones are too sombre in their shades. To obviate this inconvenience, I perform the *silicatization* of limestones which are too white with a double silicate of potash and magnesia. This is a vitreous substance, which forms a brown solution, and which when used in the process causes a little oxide of manganese to be deposited in the artificial siliceous paste. Oxide of cobalt, too, will combine, though in very small quantities, with silicate of potash. Silica precipitated by a current of carbonic acid is of a brilliant azure blue. This silicate may be used in the treatment of white marbles.

When the shades of the stone are too decided, and that is the most common defect, I obtain good results by mixing in the silicate solution a small quantity of artificial sulphate of barytes, which, in penetrating the porous stone, whilst it forms a layer of silica, remains fixed, entering, as we shall see below, into a state of chemical combination. As regards the joints, they may be made with common cements, the shades of which may be rendered lighter by means of some white substances, but they may be still more entirely concealed with broken pieces of the stone itself mixed with silicate of potash, the whole being well pulverized previous to its use, and applied in a state of liquid paste.

Coloring the Stone.—In the course of my researches for giving to these silicified stones shades which would cause those portions of our buildings which had been submitted to this process to harmonize with those which had not, I was led to submit the stones to an actual dyeing process by impregnating them in the first instance with certain metallic salts, which, by precipitation, would produce the required color.

Thus, impregnating the stones with salts of lead or copper, and afterwards bringing it into contact with sulphuretted hydrogen gas, or a solution of hydrosulphuret of ammonia, I obtain at will grey, black, or brown shades; with salt of copper and ferrocyanide of potassium I get shades of copper color, &c.

In the present case I have made an observation which in a chemical point of view is not devoid of interest.

I have stated that the porous limestones, when submitted at a boiling heat to solutions of metallic sulphates whose bases are insoluble in water, give rise during the whole reaction, to a disengagement of carbonic acid, and to the fixing in sufficient depths metallic oxides in intimate combination with sulphate of lime. When the metallic sulphates have a colored base, very beautiful tints of different and perfect shades are obtained. Thus, with sulphate of iron we get the production of a tint in red rust, more or less deep according as we operate with solutions of green vitriol more or less concentrated; with sulphate of copper the stone takes a magnificent green tint; with sulphate of manganese brown shades are obtained; with a mixture of sulphate of iron and sulphate of copper we get a chocolate color. I have, also, experimented with sulphates of nickel, chromium, cobalt, &c., and with mixtures of these sulphates.

The affinities which determine the reactions in question are sufficiently powerful to cause the metallic oxides to be completely absorbed by the stone, so much so, that certain oxides, such as that of copper, for instance, entirely disappear from the solutions after boiling with an excess of chalk.

It is remarkable, that when in operating with mixtures of salts of copper and salts of iron or of manganese, the oxides of iron and manganese are the first to be thrown down.

When we operate with sulphates having a colorless base, such as sulphate of zinc, magnesia, or alumina, we equally obtain the precipitation from the oxide, and their penetration to a certain depth in the stone, with a disengagement of carbonic acid.

The bi-sulphate of lime gives analagous results.

In general, when we intend to use colored stones in buildings, &c., or to form mosaics, it will be found useful to increase their hardness by the silicifying process.

We may proceed in the same way with articles in shell, white coral, &c., in which the color may be produced by the same process, acting at different pressures.

I will conclude this head with an important observation, which is, that the double sulphates which are formed in penetrating the stone, make a body with it, and increase its hardness to such an extent, that when certain sulphates are employed, such as that of zinc, the silicifying process becomes unnecessary.

The editor of "*Cosmos*" adds, the process which has just been described, is likely to tend to the production of a great and new industry, splendid specimens of which are to be found in the Exposition Universelle, placed in the central gallery of the "*Annexe*," on the banks of the river, opposite the produce from the mines of Anzin. We shall examine these specimens with care, and give a detailed account of them when we treat of the section of the chemical arts. The display made by the celebrated chemist of Lille is one which deserves great attention.

Cosmos.

A Railway Speculation.[*]

The East Lancashire Railway Company have adopted means similar to those some years since started by some of the metropolitan companies, to induce building operations in the vicinity of their line. To any person who will build houses within two miles of their stations at Maghull, Ormskirk, Burscough, or Town Green, of the clear annual value of 50*l.* per annum, they guarantee the privilege of nominating one resident, who shall travel free, as a first-class passenger, between these places and the Liverpool Exchange station, during a term varying from seven to eighteen years, according to the position of the houses erected.

Railway Traveling.[†]

The "*Liverpool Chronicle*" reports that "the Judge of the County court, Liverpool, lately decided in "Nash *v.* the London and North Western," that passengers whose luggage had been missent by railway officials are not in his court entitled to recover any expenses or loss of time in seeking after or waiting for such luggage, and that passengers should understand that they are entitled to sue for the full value of such luggage immediately on the loss or missending happening, without waiting for or incurring any expense in seeking after the luggage, however beneficial to the Company any efforts may be for the purpose."

AMERICAN PATENTS.

List of American Patents which issued from August 7, to August 28, 1855, (inclusive,) with Exemplifications.

AUGUST 7.

1. For a *Machine for Printing Textile Fabrics;* James Melville, Roebank Works, Great Britain, and Joseph Burch, Craig Hall, Great Britain.

Claim.—"1st, The mode of printing in two or more colors by means of a movable color apparatus, in connexion with the pattern printing roller traversing laterally on a slide rest, by means of which, the colors in a repeat are printed without shifting the printing roller. 2d, The application of a slide rest guiding apparatus for guiding and regulating the action of the pattern printing roller, when the mode of connecting such slide rest apparatus with the impression cylinder is by means of a grooved shaft traverse movement. 3d, The mode of adjusting the position of the printing roller at the repeat shifts by means of notched or serrated plates set to correspond to the different repeats. 4th, The mode of printing carpeting and other fabrics by means of printing rollers corresponding to the several colors in the repeat, set one in advance of the other in the direction of the main cylinder's revolution, that revolution being continued until the colors are duly impressed upon or into the surface."

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[*] From the London Builder, No. 645.

[†] From Herapath's Journal, No. 826.

2. For an *Improvement in Gas Regulators;* Samuel W. Brown, Lowell, Mass.

Claim.—"Constructing a quicksilver cup, or its mechanical equivalent, within the inside of the float through which the gas passes on its way to the burners, in combination with the induction tube, or its mechanical equivalent, for the purposes of constituting a self-acting valve or valve seat to evenly regulate the flow of the gas."

3. For an *Improvement in Railroad Signals;* Jacob Busser, Philadelphia, Pa.

Claim.—"The combination of the cams, spring, C, and the rods, operating upon the bell, or its equivalent, and spring P, which are placed upon the draw of the bridge, so that a locomotive, in approaching the draw, will sound the alarm, whilst a locomotive coming from the draw, will pass over the same cams without sounding the alarm."

4. For an *Improvement in Iron Houses;* D. D. Badger, City of New York.

Claim.—"The method of securing the bases of the columns to the breast summers or lintels by bolting each on the inner side to a broad flanch and keying it on the outerside by a key, whereby they are properly secured against any movement back or forth on the breast summers or lintels, or against falling outwards, but are not prevented from falling inwards when they become insecure."

5. For an *Improvement in Machines for Preparing Flocks;* Leander W. Boynton, Worcester, Massachusetts.

Claim.—"The combination of the screw with the brush or brushes, when the brush or brushes have both a rotary and reciprocating motion."

6. For a *Plane Scraper;* Leonard Bailey, Winchester, Massachusetts.

Claim.—"Combining the scraper or plane cutter with the stock by means of the movable holder and its adjustable mechanism."

7. For an *Improvement in Looms;* John Broadbent, Oak Grove, Kentucky.

Claim.—"1st, The insertion of the filling thread by means of two hooks or sets of hooks, arranged to operate one on each side of the cloth, one to carry the filling thread to the middle of the shed, where it is met by the other, which takes the thread from the first and returns with it, thus drawing the thread entirely through the warp. 2d, The employment of the said two hooks or sets of hooks, each as a deliverer, to give the thread to the other, and receiver to receive the thread from the other alternately, by which means a good and fast selvedge is made on both lists of the cloth. 3d, The employment of two tending forks made of any form and arranged and operated in any manner, to conduct the filling threads into proper positions to be caught by the delivering filling hooks. 4th, Giving the two filling hooks or sets of filling hooks, each in turn, a sufficient movement laterally to the path in which they move to insert the filling, for the purpose of enabling one to pass the other in the shed to take from it the filling thread. 5th, Giving the receiving hook a sufficient movement towards the middle of the cloth after it has drawn the filling through, and before the falling back of the ley, to disengage it from the thread of filling which it has just drawn through."

8. For an *Improvement in Machine Drills;* James Conner and Thomas Newby, Richmond, Indiana.

Claim.—"The use of the lever, vertical shaft, spring and trigger R and S, spring Z and cam, by which the action of the drill in drilling is regulated or grooved in its depth."

9. For an *Improved Method of Hanging Mill Stones;* Robert Cochrane, Cincinnati, Ohio.

"The nature of the invention consists in the arrangement by which I enable a grist mill to true itself, if, on being put in motion it is not true, and to keep itself true so long as it is in motion. There is no wabbling nor shifting, once the true centre is self-obtained, the parts keeping their true position as fixedly as if the whole was one solid mass."

Claim.—"The movable cock-eye placed in the recess on the top of the spindle, to co-operate with the cock-head fit in the balance-rine, or their mechanical equivalents."

10. For an *Improvement in Straw Cutters;* Dewitt C. Cumings, Fulton, New York.

Claim.—"1st, The upward cut, when the material is fed in by a distinct device for that purpose, by which the dirt is separated from the straw or other material to be cut, passing out beneath the feed rollers instead of collecting on the stationary guard or cutting plate. 2d, Operating the movable feed roller by means of a spur wheel hung in a vibrating frame or yoke, with a universal coupling for connecting its axis with that of the roller, when said roller is independent of spring bearings independent of each other."

11. For an *Improved Cutter-Head for Irregular Forms;* Daniel Dunlap, Concord, New Hampshire.

Claim.—"Combining with or arranging in connexion with the rotary guide and each of its knives, the cylinder crescent gauge, whereby, while the pattern or "former" is borne against the guide head, the material will not only be reduced by successive cuts until brought down to its proper depth, but the danger of accident diminished. Also, the improved mode of applying and securing each of the cutters to its stock or supports, whereby, by a force acting longitudinally of them, they are not only held in such direction, but, at the same time, are pressed laterally against the curved inner faces of the gauges."

12. For an *Improvement in Corn Planters;* Robert W. Fenwick, Brooklyn, New York, and Reinhold Boeklen, Jersey City, New Jersey.

"The nature of the invention consists in a novel combination and arrangement for operation together by alternate thrust and pull imparted to the exterior or planting tube of a valve at the lower end of the said tube, with a seed slide, which forms part of a circle and is arranged to turn on a centre."

Claim.—"The combination and arrangement of the swinging seed slide, valve, and tube."

13. For an *Improved Wrench;* Alden Graham, Roxbury, Massachusetts.

Claim.—"Fitting the jaws, when turning on pivots, in the slot, and operating the same by a ring having a screw thread on its inner surface, to work between threads cut on the outer surface of the jaws."

14. For an *Improvement in Apparatus for Discharging Atmospheric Electricity from Telegraph Wires;* John N. Gamewell, Camden, South Carolina. Patented in England, September 15, 1855.

"The nature of the invention consists in an instrument which is intended to connect the main wire of the telegraph with the receiving magnet at every station, for the purpose of transmitting only the galvanic or writing current, and discharging into the earth before it can arrive at the magnet, all atmospheric electricity, with which the wires become surcharged, when the atmosphere is in a highly electrical state."

Claim.—"The method of obstructing the passage of atmospheric electricity along the line from one discharging point to another, or their equivalents, provided for a similar purpose, by reducing the capacity of the conductor forming said line, and immediately after its junction with the discharging points, whether that reduction consists in the employment of an inferior conducting material, or in reducing the dimensions of the conductor, or any other equivalent method of reducing the conducting capacity of those parts of the line, thereby forcing the discharge of the atmospheric electricity from the points."

15. For a *Gauge Attachment for Hand Saws;* A. F. Gray and J. C. Fincher, Thibodeaux, Louisiana.

Claim.—"Attaching to one side of the blade of a hand saw, a gauge formed of two strips and lugs, having slots made in them, through which slots, set screws pass, the screws also passing through the saw blade."

16. For an *Improvement in Braiding Machines;* Liveras Hull, Charlestown, Mass.

"The object of my machine is to braid the external covering of a whip stock or handle, said machine being equally adapted to braiding cords or for covering threads of caoutchouc."

Claim.—"The arrangement of the bobbin, the pawl, and the weight within the racer, or with respect to one another therein."

17. For an *Improved Mode of Securing Tires upon Wheels;* John L. Irwin, Franklin, Alabama.

Claim.—"Attaching or adjusting tires to wheels by having the ends of the tires bent, so as to form lips or projections, through which a screw bolt is passed for the purpose of drawing the ends of the tires together and fitting the same tightly to the felloes or rim, the rim having a recess made in it to receive the lips or projections and screw bolt, the recess being covered by a cap."

18. For an *Improvement in Ships' Winches;* Peter H. Jackson, City of New York.

Claim.—"The reversible or double acting pawl, 4, below the ratchet wheel, in combination with the double acting pawl, *d*, to which power is applied to rotate said ratchet wheel in either direction."

19. For an *Improvement in Propelling Vessels by the Direct Action of Steam on the Water;* William J. McIntire, City of New York.

Claim.—"Protecting the steam from condensation by discharging at the same time with it, some non-condensible gas or gases or fluids, or both in combination, in such a manner as to form an envelope for the steam."

20. For an *Improvement in Manufacturing Carpets;* John G. McNair, West Farms, New York.

"The object of my invention is to produce a fabric having a figure on the two surfaces, like what is known as the ingrain carpets, with the colors of the figure reversed, but without a figuring warp."

Claim.—"The fabric described produced by the double wefts, one or both of which is parti-colored, in combination with the two sets of warps, one to divide and ingrain the wefts, and the other to bind in the wefts."

21. For an *Improvement in Dental Chairs;* D. W. Perkins, Rome, New York.

Claim.—"1st, Tightening the ball and socket joint, so as to secure the body of the chair in the desired position, by means of the band which encompasses the socket, the band being operated upon by a clamp, whereby the parts, *e f g*, of the socket may be pressed or bound snugly around the ball. 2d, Attaching the head rest to the inner edge of the plate O by hinges, and having the head rest secured at the desired angle of inclination by a segment rack, P, the plate O being allowed to slide laterally upon a plate Q at the upper part of the bar, which bar works in an opening in the back of the chair, and is secured at the desired point by the rack V and spring catch, for the purpose of rendering the head rest capable of perfect adjustment."

22. For an *Improved Machine for Measuring and Weighing Grain;* Charles A. Postley, Philadelphia, Pennsylvania.

"The nature of the invention consists in a new and improved combination of parts, for the purpose of measuring and weighing all kinds of grain, and giving the weight of every bushel as measured at the time of removing."

Claim.—"The combination of the weighing mechanism, or its equivalent, with the series of measures upon an endless chain, which carries them in succession under the hopper, under the strike, and over the scales. Also, the combination with the lever, M^2, and valve respectively of the lever M, operated by the cam, or its equivalent, and of the platform and levers *g* and g^2, by which the said valve may be operated by the motive power of the machine, or failing this at any time, by the weight of the grain itself."

23. For an *Improved Mode of Adjusting Blinds to Windows, &c.;* Charles E. Parker, Boston, and Joseph Sanger, Watertown, Massachusetts.

Claim.—"Attaching the ropes or chains to the two parts of the blind, *c c*, so that a portion of the ropes or chains will pass on the outer side of the casing and within the apartment or house, and thereby allow the parts of the blind, *c c*, to be adjusted as desired without raising or opening the sashes."

24. For a *Machine for Sawing Lumber;* R. E. Parkhurst, Brunswick, Maine.

Claim.—"1st, The method of connecting the rack bar to the carriage, so that the bar may have a slight motion independent of the carriage. 2d, The dogs, in combination with the notched bar, whereby they may be instantly moved and set to accommodate them to different lengths of log. 3d, The method of connecting the dogs with their sliding guides, whereby they may be operated longitudinally and transversely. 4th, The pointed screw dogs. 5th, The saw guide, so constructed as to be thrown out of the way by the log. 6th, The double dog, which, when out of use, may be sunk flush with the surface of the head block, and may be run in and out for the purpose of sawing the but and point of shingles."

25. For an *Improvement in Seed Planters;* Silas G. Randall and James H. Jones, Rockton, Illinois.

Claim.—"The use of a sheath and a tongue filling it, so combined with a lever and forcing handle, that by means thereof, or their equivalents, the sheath and tongue may be struck into the ground as one solid piece, after which the tongue may be raised, leaving the sheath in the earth as a lining until the seed is deposited through the lining."

26. For an *Improvement in Molasses Pitchers;* Edward Page, Worcester, Mass.

Claim.—"The application to molasses cups of a vessel to catch the molasses which drips from the cup, and the vessel to swing."

27. For an *Improvement in Forming Screw Threads, &c., in the Necks of Glass Bottles and similar articles;* Amasa Stone, Philadelphia, Pennsylvania.

Claim.—"The construction of tools for forming screw threads angular or other scores in the necks and orifices of glass, earthen, or other bottles, and other articles, by making the plug which forms the interior of the orifice to turn with the bottle, jug, or other article, while the material of the orifice is worked around it."

28. For an *Improvement in Tanning Apparatus;* George W. Smith, Nanticoke, N. Y.

Claim.—"Surrounding the ordinary tan leaches with a water chamber, not limited to a particular form or mode of structure, but comprising any form by which the leaches are surrounded by water spaces. (The object being to preserve the leaches from decay.)"

29. For an *Improvement in the Construction of Artificial Legs;* Addison Spaulding, Lowell, Massachusetts.

Claim.—"1st, The knee spring, or its mechanical equivalent, for throwing forwards the portion of the leg marked A, at each step of the artificial leg. 2d, The ankle spring, or its mechanical equivalent, for swinging up the forward portion of the foot on the axis or pin or other turning point at each step of the operator. 3d, The chain or rod connected and combined with the india rubber, or their mechanical equivalent, which is secured in the heel of the foot to allow the leg A a slight elasticity when placed upon the ground, and tipped forward by the operator, to prevent the shock upon the cords and nerves in the stump of the natural leg."

30. For an *Improved Self-Adjusting Tongue Iron;* William J. Temple, Princeton, Massachusetts.

Claim.—"Making the part B (the iron) movable and self-adjusting, in connexion with the lever, or any similar means to raise it."

31. For an *Improvement in Oil Drippers;* James M. Thompson, Holyoke, Mass.

Claim.—"The arrangement of the chamber, in combination with the tubes."

32. For an *Improvement in the Bed Spring of Leather Splitting Machines;* John B. Tay, North Woburn, Massachusetts.

Claim.—"A bed or back spring, as composed of a thin guard or spring sheet of metal and a series of separate springs united to or forming part of a plate."

33. For a *Spoke Machine;* William Van Anden, Poughkeepsie, New York.

Claim.—"1st, The use of the upper and lower adjustable cutter holders made adjustable laterally on their axis, in combination with the curved stationary cutters and adjustable cutters and collars for adjusting the same, or their equivalents. 2d, The use of the adjusting yoke and the attachments thereto for adjusting the cutter holders, or their equivalents, in combination with the cutter holders on the spoke rest carriage, or their equivalents. 3d, The use of the double acting adjusting levers, or their equivalents, in combination with the cutter holders and their axles, and their combination with the pawls attached to the double acting adjusting levers and cams for operating the same, or their equivalents."

34. For an *Improved Machine for Attaching Hooks and Eyes to Cards;* Addison Capron, Attleborough, and Joseph S. Dennis, Somerville, Massachusetts, Assignor to selves and Henry M. Richards, Attleborough, Massachusetts.

Claim.—"The combination, or substantially the same, of a feeding receiver made to receive the articles and maintain them at proper distances asunder, a cord or sheet feeding mechanism, and sewing machinery on one or both sides of said receiver."

35. For an *Improvement in the Manufacture of Daguerreotype Cases;* Halvor Halvorson, Cambridge, Massachusetts, Assignor to Horace Barnes, Boston, Mass.

Claim.—"The improvement in the manufacture of picture cases or other articles of like character from a composition of shellac and fibrous material, the same consisting in making said case or article of the said composition and one or more sheets of paper, and pressing and combining the whole together in a press or between dies, so that the paper shall combine or connect itself directly with the composition without the aid of cement interposed between them, and serve to add great strength to the article so made. Also, the improvement of ornamenting the surfaces of the impression of the die with burnished gold, the same consisting in applying the gold to the surfaces of the sheet of paper, or its equivalent, burnishing it while on said surface, and laying the said burnished surface in contact with the surface of the die, and pressing said paper and the plastic composition together and into the die, so as to force the burnished gilding paper and composition upon it. Also, the extension of the paper up the inner surfaces of the sides of the case, and by means of pressure in the moulds, the same being for the purpose of enabling to affix to the side the velvet covered frame for the support of the picture, the mat, and the glass thereof."

36. For an *Improvement in the Manufacture of Plate Glass;* Phillippe Stenger, Assignor to Pascal Yearsley, Philadelphia, Pennsylvania.

Claim.—" The application of tractile force to the manufacture of plate glass by means of the mechanical arrangement described, or its substantial equivalent."

37. For an *Improvement in Machinery for Making Paper Pulp;* Lewis Koch, Assignor to Peter B. Sweeney and Michael Lacour, City of New York.

Claim.—"The combination of a series of rollers, increasing gradually in diameter and speed in proportion as the wood or fibrous vegetable substance is extended or pressed out. The face or circumference of one of every pair of extending rollers having a greater speed than the face of its corresponding roller, producing thereby a slight dividing or separating motion in connexion with the pressure upon the substance, which separates each fibre without destroying the same, for the purpose of making pulp from wood and fibrous vegetable substances."

38. For an *Improvement in Temples for Looms;* James Smith, Laurel, Maryland, Assignor to self and William Bothwill, Howard County, Maryland.

Claim.—"The temple roller formed with solid raised conical shaped pin teeth, having a hinged cap to its case, all attached to a flexible rod, in combination with the forked spring when adjustable in brackets."

AUGUST 14.

39. For an *Improved Egg-Holder;* Francis Arnold, Haddam, Connecticut.

Claim.—" Securing or holding eggs within boxes, or on table casters, and other articles, by means of the elastic clamps, constructed as described, or in any equivalent manner."

40. For an *Improvement in Governors for Steam Engines, &c.;* John Arthur and Evan Arthur, New Brunswick, New Jersey.

Claim.—" A governor composed of one or more arcs, rings, or bands of elastic material, applied to a revolving spindle, with a rigid attachment to the said spindle at one point and a loose or sliding attachment at another point, the sliding part or parts being connected with the throttle valve."

41. For an *Improvement in Making Zinc White;* John E. Burrows, Newark, N. J.

Claim.—"The manufacture of white oxide of zinc from ores of zinc or franklinite, by means of a furnace, having perforated grate bars, and an air chamber underneath them, in which hot or cold blasts of air are forced to unite with the ignited mass of fuel in a different state, by passing through the perforations of the grate bars to liberate the zinc in the form of vapor, in manner of construction and mode of operation as set forth."

42. For an *Improvement in Apparatus for Replacing Cars;* Fortune L. Bailey, Freeport, Indiana.

Claim.—"The arrangement of eccentric wheels on either side of the rails, the outer ones being slightly smaller than the inner ones, so counterpoised, that the smaller portion of said eccentrics shall remain downward when not in use, for the purpose of lifting and directing the cars on to the track, when they have been thrown off, by rolling upon said eccentric wheels."

43. For an *Improvement in Whiffle Trees;* Oramel C. Barnes and O. J. Barnes, Stockbridge, Vermont.

Claim.—"The application of the angle shaped iron, forming the solid iron groove, together with the wedge and bearing for the hook."

44. For an *Improvement in Corn Planters;* Andrew J. Barnhart, Schoolcraft, Mich.

Claim.—"Operating the box and plunger, by means of the rods attached to an oscillating arm, which is placed on the shaft of the distributing roller, whereby the box and plunger are made to move simultaneously in opposite directions."

45. For an *Improvement in Compositions for Treating Rubber and Gutta Percha;* Francis Baschnagel, City of New York.

Claim.—"The conversion or restoration of caoutchouc or gutta percha, whether they have been vulcanized or not, into a soft, plastic, and workable state, (by a combination of chemical agents,) so that they may be re-manufactured in a state already vulcanized or not, according as the substance converted or restored had or had not been vulcanized. The substances which I use for this purpose, being bi-sulphuret of carbon in conjunction with alcohol absolute, and not common alcohol, without the addition of any other chemical agent and without the application of heat. To 100 pounds of caoutchouc or gutta percha cut in pieces, add ½ pound of alcohol absolute and ten pounds of carbon bisulphuratum, the whole to be placed in a vessel hermetically sealed, and allowed to remain closed for two hours."

46. For an *Improvement in Churns;* Jacob Boyers, Granville, Virginia.

"The nature of the invention consists in giving such a direction to the cream placed in the tub of the churn, by the action of the agitator, that it shall assume the character of a screw, whereby the butter, by an action resembling that of wringing clothes, is separated from the butter-milk in a more solid condition and gathered in a mass at one side of the churn."

Claim.—"The shaft, in combination with the dashers, when arranged and combined in the manner as set forth."

47. For a *Mode of Straining Saws by Atmospheric Pressure;* A. Brown and Abel Coffin, Jr., Sabine City, Texas.

Claim.—"Providing the closed ends or heads of the cylinders with "shifting" valves, opening outwardly and freely hung or operating when the said cylinders with their pistons are arranged in relation to the saw, and the pistons and valves operate together, whereby, the reciprocating action of the saw is made to clear the cylinders without the aid of a separate exhaust pump."

48. For an *Improved Hand Press for Printing;* Dexter H. Chamberlain, West Roxbury, Massachusetts.

Claim.—"1st, The "percussion hand press," consisting essentially of the block or type carrier sliding upon the lever, the ink roller, and bed. 2d, The method of adjusting the head to the surface of the types, whatever may be the thickness of the plate which carries them."

49. For a *Ventilating Faucet;* Charles Cleveland, Ashfield, Massachusetts.

Claim.—"The combination of a ventiduct with a faucet."

50. For an *Improvement in Steam Boilers;* J. J. Dutcher, New Haven, Connecticut.

Claim.—"1st, Placing within the cylindrical water body of a boiler, one or more cylindrical flues, terminating at their ends in frustums of cones, which frustums all have the truncated ends towards the fire box and the bases towards the chimney, and serve to form communication through the cylinders from the fire box and towards the chimney. 2d, The arrangement of the two cylinders, cones, pipes, and passages."

51. For an *Improvement in Cotton Presses;* H. H. Fultz, Lexington, Miss.

Claim.—"The arrangement with the retaining and driving pawls on either side of the follower rod or rock bar of the one spring, bearing at its opposite ends on the said pawls and hung upon an intermediate pivot in relation thereto, so that, upon turning the spring, both the retaining and driving pawls are expeditiously and simultaneously relieved from or thrown into spring gear with the follower rod, and the working of the follower in its reverse directions is expedited."

52. For an *Improvement in Alloys for Journal Boxes:* Joseph Garratt, Sen., Indianapolis, Indiana.

Claim.—"The production of an alloy of a bluish gray color, which, while it has unsurpassable anti-friction qualities, has also sufficient tenacity to allow of journal boxes being formed of it that do not require the protection of outer casings of a harder metal, the said alloy being composed of zinc, copper, and antimony in about the following proportions, viz: seventeen parts zinc, one part copper, and one part and a half of antimony, or any other mixture substantially the same and which will produce the same effect."

53. For an *Improved Extension Vehicle;* Benjamin W. Gay, New London, N. H.

"The nature of the invention consists in so constructing vehicles, whether on runners or wheels, as to be capable of being extended to a double seated, or contracted into a single seated conveyance, by means of a double or single screw perch connecting the fore and hind bed pieces together."

Claim.—"1st, The screw perch. 2d, The application in combination with said screw perch of the rods."

54. For an *Improvement in Windlasses;* W. N. Gesner, Fair Haven, Connecticut.

Claim.—"The employment or use of the guide pulley attached to the frame, the frame being connected to the framing or block."

55. For an *Improvement in Hernial Trusses;* E. B. Graham, Middletown, N. Y.

Claim.—"The means of adjusting and securing the pad in any desirable position, consisting of the square toothed rack, the adjustable square toothed and slotted spring catch, and the screw, all combined and applied as set forth."

56. For an *Improvement in Making Zinc White;* Samuel T. Jones, City of N. Y.

Claim—"The manufacture of white oxide of zinc from ores of zinc or franklinite, by means of a furnace having perforated grate bars and an air chamber underneath them, in which hot or cold blasts of air are forced to unite with the ignited mass of fuel in a diffused state, by passing through the perforations of the grate bars to liberate the zinc in the form of vapor, in manner of construction and mode of operation as set forth."

57. For *Furnaces for Heating Buildings;* Joseph Leeds, Philadelphia, Pa.

Claim.—"Combining with the cylinder or fire pot of an air heating furnace, a reservoir or fountain of water, which furnishes a wet surface, against which the incoming air strikes for moistening it and depositing its dust, and a series of curved zigzag fluted or corrugated plates for enlarging the heating surface of the furnace, and forming airducts for the heated air to pass through."

58. For an *Improvement in the Cutting Apparatus of Harvesters;* Robert J. Morrison, Richmond, Virginia.

Claim.—"The hinging of the lids and allowing them to rest severally and independently upon the moving cutters."

59. For an *Improved Forging Machine;* Daniel Nayes, Abington, Massachusetts.

Claim.—"1st, Attaching the hammer or hammers of a forging machine beach by a pivot to a revolving disk or crank, so as to revolve therewith, and controlling the position thereof by stops attached to the face of the disk or crank, whereby, after the hammer has been caused to strike on the anvil by the revolution of the disk or crank, it will be, by the continuous revolution thereof, drawn lengthwise of the anvil to enable its revolution to continue for another blow. 2d, The employment of an anvil with a face forming the interior of a right angle, in combination with two hammers operating at right angles to each other against the said faces. 3d, The arrangement of the movable carriage or rest relatively to the two faced anvil and the hammers."

60. For an *Improved Mode of Hanging Window Sashes;* L. E. Payne, Yazoo City, Mississippi.

Claim.—"Applying the cords to the sashes, viz: the cords passing around the lower sash, so that said cords may work around the lower sash, or said sash may be raised or lowered without moving the cords."

61. For an *Improvement in Machines for Gathering Cotton Stalks;* Richard Ray Louisport, Kentucky.

Claim.—"The arrangement of the apron, plate, and rake, for the purposes of pulling up and gathering stalks of cotton."

62. For an *Improvement in Gas Regulators;* Stephen P. Ruggles, Boston, Mass.

Claim.—"In combination with a gas burner, a floating tube, which stands across and controls the flow of gas through the gas way."

63. For an *Improvement in Harvesters;* Fisk Russell, Boston, Massachusetts.

Claim.—"So arranging the rocker frame, that it may rotate in the end of the lever while said rocker frame is operated upon by the serpentine cam wheel which it embraces."

64. For an *Improvement in Furnaces for Heating Buildings;* Samuel B. Sexton, Baltimore, Maryland.

"The nature of the invention consists in covering the fire chamber with a pair of concave convex plates, placed one above the other, with their convex surfaces outward, and slightly separated along their edges. The space between the concave surfaces of the plates communicating by a pipe with the external air, so that a current will pass through this space, and issue from the opening between the edges of the plates into the main air chamber and pass from thence by the usual exit flues."

Claim.—"The convertible covers of the fire chamber, in combination with the pipe."

65. For an *Improvement in Railroad Car Brakes;* Gustavus Adolphus Somerby and Charles William Fogg, Waltham, Massachusetts.

Claim.—"Applying the wheel axle to the frame by means of pendulous bars, in order that the gravity or weight of the carriage, when the latter is at rest, (as well as when it is in motion,) may be employed to press the wheels against the brakes by acting through such bars, when they are inclined from the vertical and are left to be free to be moved towards the brakes. Also, so combining with either or both the lower brakes, one or more other brakes, or brake mechanisms, that the latter may be put in action by the operations of the wheels on the former. Also, in combination with wheels, applied so as to be movable towards and away from their brakes, a mechanism, whereby the power that produces draft of the carriage or puts it in motion, shall move such wheels away from their brakes, so as to relieve the said brakes from being moved or pressed by their respective wheels."

66. For an *Improvement in Cotton Gins;* John Simpson, Lewisville, S. C.

Claim.—"Making the alternate saws of a greater diameter than the intermediate saws, in order that no two adjacent ones may seize the same fibres, and thereby break them, but, at the same time, to gin as completely and rapidly as if the saws were all of the same diameter. Also, arranging the brushes, which sweep the smaller saws, upon alternate wings projecting out from the centre as much further than the intermediate wings, which bear the brushes for sweeping the larger saws, as said saws project beyond the other, for the purpose of rendering the brushes all of a uniform and suitable length. Also, arranging the mote board, so as to slide backward or forward, for regulating the strength and direction of the blast and properly separating the motes from the cotton, and also to be used as a lid to entirely close said space when the gin is not in use."

67. For an *Improvement in Gun Locks;* Michael Trowley, Mount Vernon, Illinois.

Claim.—"Constructing the lock by having the lower part of the hammer formed of two prongs, *d e*, against one of which the spring *c*, bears, and having the upper end of the tumbler attached to the other prong *e*. The lower end of said tumbler being attached to the upper end of the trigger. The front end of the spring *c* having a small spring *l* attached to it, which spring *c* bears against the trigger."

68. For an *Improvement in Tanning Compounds;* Otis B. Whattles, Waddington, New York.

Claim.—"1st, The employment or use of soap, combined with salt and lime for unhairing or depilating the hides. 2d, The employment or use of soap, combined with the tan liquor for tanning the hides."

69. For a *Portable Steam Sawing Machine;* Samuel R. Wilmot, City of New York.

Claim.—"1st, The attachment of the opposite end of the steam cylinder to that at which the saw works, by a pivot to the main frame or bed piece of the engine, so that the cylinder may swing to and from the said frame or bed piece for the purpose of allowing the saw a proper range and feeding it. 2d, Furnishing the main frame or bed piece of the engine with dogs to drive into the tree or log on opposite sides of the saw, whereby greater stability is given to the engine and saw when in operation without making the engine or its frame of great weight."

70. For an *Improved Device for Opening and Closing Gates;* Caleb Winegar, Union Spring, New York.

Claim.—"The fan wheel and shaft, the cog wheel, the ratchet wheel, and spring catch, as applied to said invention, not limited to the precise arrangements, but to vary the same at pleasure while obtaining the same ends by means substantially the same."

71. For a *Method of Drawing Water from Wells;* Caleb Winegar, Union Springs, New York.

Claim.—"The guiding of the bucket by means of two wires, or their equivalents, suspending two weights near the bottom of the well in combination with the gate frame."

72. For an *Improvement in Coffee Roasters;* Samuel Pierce, Assignor to Curtis B. Pierce, Troy, New York.

Claim.—"Constructing the roasting vessel of a series of alternate longitudinal angular parts projecting inward and co-extensive concave portions swelling outward."

73. For an *Improvement in Mills for Compressing and Grinding Grapes and other Small Fruits;* Z. Coleman Robbins, Washington, D. C., Assignor to Anson Martin, Norwich, Connecticut.

Claim.—"The combination and joint action of the compresser and the cylinders for compressing and grinding grapes."

74. For an *Improvement in Apparatus for Sifting;* Edward Louis Seymour, Assignor to W. O. Bourne, City of New York.

Claim.—"The several cylindrical sieves, one within the other, provided with conduits, so arranged as to deliver the proceeds continuously."

AUGUST 21.

75. For an *Improvement in Candlesticks;* C. W. Blakeslee, Northfield, Connecticut.

"The nature of my invention consists in extending the upper ends of the wires which form the body of the candlestick, through a dish shaped plate, so as to form a spring socket for the reception of the candle."

Claim.—"I do not claim forming the body and base of the candlestick of wire, neither do I claim a spring clamp or socket in itself considered or independently of the mode of constructing or forming the same, as herein shown, for they have been previously used; but I do claim extending the wires of the body of the candlestick through a dish shaped plate substantially as shown, for the purpose of forming a spring socket for the reception of the candle."

76. For an *Improvement in the Application of the Conical Pendulum to Time Keepers;* John C. Briggs, Concord, New Hampshire.

"The nature of my invention consists in causing the pendulums of clocks to oscillate in circles or ellipses, the motion being kept up by spindles coming up from below, within the circumferences described by the pendulum balls."

Claim.—"The application to clocks, time pieces, or other machinery, as a regulator of a rotary or conical pendulum, the rod of which is flexible and attached at its upper end to a fixed point above and without the described cone, and extending only below the point of support; the pendulum to be kept in motion by a spindle coming up from below."

77. For an *Improvement in Sealing Cans;* William Burnet, Cincinnati, Ohio.

Claim.—"The use of a clamp cap constructed substantially as described, for the purpose of closing the opening in the can between the filling and the final sealing thereof."

78. For an *Improvement in Obstetrical Extractor;* Almond C. Buffom, Chicago, Ill.

Claim.—"An obstetrical extractor, which, from the peculiar form of its fingers and by means of three cross bands interlaced by down straps, so clasps and supports the head of the child, as that the force necessary to assist its delivery can be applied without injury to mother or child. Also, that by means of the frustra the instrument can be ready for application, so small and of such shape, that it can be applied more readily and with less risk and pain to the patient than any forceps or other extractor in use."

79. For an *Improvement in Glass Journal Boxes;* Edward Campbell, Columbus, O.

Claim.—"I do not claim the union of glass and iron, whilst the former is in a plastic state and the latter at a red heat, by pressure to produce a welding of the two; but what I do claim is, a journal box composed of an iron body and an anti-friction lining surface of glass, when the said glass lining is combined with its iron back, as set forth."

80. For a *Swimming Glove;* Dugald Campbell, City of New York.

Claim.—"The use or employment of flexible webs uniting the thumbs and fingers of gloves."

81. For an *Improved Wrench;* John D. Dale, Philadelphia, Pennsylvania.

Claim.—"1st, The combination of the reversible flanched and winged hub and pawls with the upper and lower ratchet wheels, constructed and operated as described. 2d, The combination of the angular jaws and worm plate, or their equivalents, with the upper and lower ratchet wheels, and the mechanism giving them a continuous motion either to the right or left."

82. For an *Improved Basin Stop-Cock;* Henry Eling, City of New York.

Claim.—"I do not claim closing a cock by means of a spring when said cock is not provided with a screw valve; but I do claim making the cap independent of the nut, so that by simply loosening the nut, the cap may be turned and the valve adjusted."

83. For an *Improved Pressure Water-Wheel;* William Fields and Solomon Gerhard, Wilmington, Delaware.

"The nature of my invention consists in combining with a water-wheel, running in a case or chute, a balance valve hinged in the centre."

Claim.—"The combination of the valve with the buckets upon the wheel revolving in the case."

84. For an *Improvement in Pumps;* Sylvester H. Gray, Bridgeport, Connecticut.

Claim.—"I do not claim operating the two pistons of a single cylinder double acting pump by means of two racks and a pinion, when said racks and pinion are arranged above the top or below the bottom piston, and the rod of one piston passed through the rod of the other; but I do claim the employment and arrangement of the rod and pinion combined between the pistons."

85. For an *Improvement in Hemp Cutters;* J. Lock Hardeman, Arrow Rock, Mo.

Claim.—"1st, The side reel constructed and applied for hemp, grain, or other articles of like nature, such reel having curved arms, be the curvature more or less. 2d, The cleaning shears."

86. For an *Improvement in Bridges;* Horace L. Hervey, Quincy, Illinois, and Robert E. Osborn, Springfield, Ohio.

Claim.—"The arrangement of the blocks and posts, in combination with the adjustable suspension truss, the arched truss, and the tension cord, so that the camber of the bridge may be increased or diminished by the adjustment of these blocks, in connexion with the tension cord, so as to increase the strength of the bridge by lessening the strain on any one point by distributing it to many points by means of the adjustable blocks. 2d, Constructing and arranging the blocks which sustain the tension braces of the suspension truss, so that they will slide or traverse on the string pieces, so as to equalize, distribute, and proportion the load more uniformly and over a larger portion of the bridge. 3d, Supporting the floor timbers alternately or successively by the arch and suspension trusses."

87. For a *Machine for Engraving Calico Printers' Rollers;* John and Thomas Hope, Providence, Rhode Island.

Claim.—"The combination and arrangement of the two sets of measuring markers, the hold-back rods and roller, with plane surface table, the same being not only to enable the design to be transferred, it being brought forward in regular sections, but to be maintained flatly upon the table. Also, the two measuring indices, in combination with the large pulley and the shaft of the driving roller of the cylinder to be engraved. Also, the means of holding and moving the cylinder, so that it shall not only be rotated by pressure against its external surface, but may be readily either removed from or applied to its supports, the same consisting in employing a driving roller and a bearing roller at one end of the cylinder, in combination with two sets of bearing rollers made to extend into a groove around the cylinder, and to support such cylinder both laterally and longitudinally. Also, the arrangement of the pattern table, the tracer, and its carriage, the several other carriages, the mechanism for operating each, the wheel, its shafts, and the supports of the roller to be engraved, the whole constituting an improvement in engraving machinery and securing to it important advantages in operation as well as in construction."

88. For an *Improved Apparatus for Vessels to indicate their locality when they sink, and to supply a means of raising them;* Joseph Hyde, City of New York.

Claim.—"I am aware, that on some occasions in throwing guns, anchors, and other heavy articles overboard to lighten ships at sea, cords with floats have been previously attached, to indicate their locality when sunken, but I am not aware that buoys, specially provided, have ever been arranged and connected with a vessel or anything within it, so as to remain so connected and give out the connecting cord, to remain on the surface of the water as the vessel sinks, to indicate its locality and afford the means of forming the necessary connexion for raising the vessel, &c., to the surface, and, therefore, I do not claim, broadly, the use of floats to indicate the locality of sunken articles. I do not wish to be understood as limiting myself to the special construction of the buoys, nor to the special manner of arranging the cord which forms the connexion between the buoy and the socket or the hose, nor to the special construction of or mode of attaching the socket to the vessel or safe, nor to the mode of making the flexible bags or camels and hose, nor to the special construction of the grapple, as all these may be varied without changing the character of my invention. What I claim is, the mode of operation for indicating the locality of sunken vessels by means of a buoy or buoys connected and combined with the vessel by means of a cord or cords, or the equivalent therefor, attached to the buoy, and a windlass, or equivalent thereof, and connected with the vessel or some valuable within the same. Also, the mode of operation for connecting cables or chains with sunken vessels or articles therein by means of the socket, or any equivalent therefor, operated by the buoy cord."

89. For an *Improvement in Railroad Car Seats;* Ebenezer Jeffers, Dorchester, Mass.

Claim.—"I am aware that a chair seat has been so combined with its legs or supporting frame as to be capable of being rotated horizontally; I am also aware, that it is not uncommon to apply a table or other article to a stand by such devices as will admit of its being moved in either a horizontal or vertical direction. I therefore, do not claim such; but I do claim arranging the pedal, the bolt, and their locking recesses, together and in the sector, and in the turning and stationary posts, as described, and so that by one single movement of the pedal, the sector and the turning post may be latched or unlatched simultaneously, so at to enable the chair to be operated."

90. For an *Improvement in Journal Box Alloys;* Benjamin F. Lawton, M. D., Troy, New York.

"My improved alloy consists of wrought iron, copper, tin, and arsenic, combined in various proportions, according to the degree of hardness, toughness, or other quality it is desired to make it a superior alloy or box metal."

Claim.—"The aforesaid alloy or box metal as a new material, for the purpose of forming boxes, journals, axles, and all other rubbing surfaces of the moving parts of machinery."

91. For an *Improvement in Journal Box Alloys;* Benjamin F. Lawton, M. D., Troy, New York.

"My improved compound box metal or alloy consists of cast steel, nickel, copper, and tin, prepared and admixed in various proportions, according to the requisite degree of toughness or other quality that may be desired to make it a superior box metal or alloy."

Claim.—"The aforesaid box metal or alloy as an improved material for the purposes of forming locomotive crank boxes, piston rings, journals, boxes, axles, and other rubbing surfaces of the moving parts of machinery."

92. For an *Improvement in Warm Bath Apparatus;* Louis H. Lefebore, New Orleans, Louisiana.

Claim.—"The portable steam bath apparatus, composed of a double generator, so arranged, that the products generated in the two compartments may be conveyed to the bath mingled or separated, of a bag and of a connecting pipe, each of said parts constructed and arranged as described."

93. For an *Improvement in Pressure Gauges;* John Matthews, Jr., City of N. Y.

"My invention consists in certain improvements in instruments for ascertaining the pressure of gases and fluids, and is chiefly designed for a steam pressure or vacuum gauge."

Claim.—"The construction of a gauge tube in the manner set forth, that is to say, having off-sets thrown out along one side for the purpose substantially as described."

94. For an *Improvement in Percussion Projectiles;* Augustus McBurth, Elizabeth, New Jersey.

"My invention consists in the construction of a bomb shell, (or missile,) that contains all the properties of the cannon ball, together with a more destructive and certain effect than the bomb shell."

Claim.—"The improvement in bomb shells or missiles having four arms and eight flutes with sharp edges, in the manner and for the purpose substantially as described. Also, a rod to pass through the shell in a longitudinal course for the purpose set forth. And, also, a hammer with a flat spring attached, together with a spiral spring, as substantially shown and described."

95. For a *Hand Stamp;* Stephen P. Ruggles, Boston, Massachusetts.

"The nature of my invention relates, first, to the manner of connecting a plate to the handle by means of a screw cap to facilitate a change of plates; also, in holding the ball to the socket by a pin and its accompanying parts to prevent the spring from coming out."

Claim.—"The connecting of an electrotype plate to the handle of the stamp by means of a screw cap, for the purpose of facilitating the removing and replacing of the electrotype or portions thereof as set forth. Also, the combination of devices for holding the bed plate to the shank, so as to preserve the ball and socket or yielding point, prevent them from being separated, and to keep the coiled spring in place, the same consisting of the flanches on the bed plate with the holes therein, the large opening in the shank piece, and the pin passing respectively through them."

96. For an *Improvement in Railroad Car Seats;* Albert M. Smith, Rochester, N. Y.

Claim.—"I do not claim the form or shape of the back or seat part of the car seat, as they are in common use; but I do claim the constructing and arranging of the car seat, so that the whole back of sufficient width and shape best adapted to support the body of a person for day riding, if changed either side of the seat to ride either way, can be reversed, the outside turned inside, thereby, and at the same time, raised high enough to support the head and body equally well for night riding by means of and in combination with the different devices, or their equivalents necessary for the purpose."

97. For an *Improvement in Horse Yokes;* John Woodward, Wilmot Flat, N. H.

Claim.—"I do not claim a horse yoke consisting of two eveners or horizontal bars, a connecting or vertical bar, two sets of harness and ham connexions, arranged at the upper and lower ends of the harness, such being represented in the patent of Elijah H. Dantforth, granted July 28, 1846; but I do claim my improved mode of constructing and arranging the hame connexions with respect to a single beam, whereby such hame connexions may be attached to the middle of the hames instead of at their ends, and thereby render but one bar or bearer necessary to connect the hames and the pole of a carriage."

98. For an *Improved Door Knob;* Alonzo E. Young, Dorchester, Massachusetts, Assignor to self and Mark Worthly, Boston, Massachusetts.

Claim.—"What I claim, is, the sliding clutch and its attachments applied to the shank, and the socket, and the movable knob."

99. For an *Improvement in Breech Loading Magazine Fire Arms;* John Swyney, Charlestown, Massachusetts, Assignor to self and James Dandridge, Boston, Mass.

Claim.—"The carrier, its spring, in combination with the magazine or tube, for the purpose of bringing a cap from the magazine downwards or into line with the rammer. Also, the rammer, in combination with the rammer and the mechanism by which they are connected, so as to operate together, as described, such mechanism consisting in part of the rod and the lever. Also, combining with the charge chamber and the magazine the intermediate chamber or carrier, said charge chamber and carrier being connected with and operated simultaneously by the guard."

100. For a *Machine for Sawing Shingles;* Charles Ketcham, Assignor to Charles G. Judd and Andrew Oliver, Penn Yan, New York.

Claim.—"1st, the feeding trough for containing the shingle or stock block, constructed as described, and arranged in relation to the means for feeding and the means for cutting. 2d, The receiving trough, having the grooves in it to receive each shingle while being cut, and holding them sufficiently to permit their easy and ready removal from the saws in compact and orderly condition. 3d, The arrangement of the adjustable inclined levers by pressure exerted in the line of the edge of the shingle being cut by means of the rollers, or their equivalents, held and moved substantially as stated, in contradistinction to the holding of the block by lateral and end pressure, as is usual in shingle making machines, so that the shingle being cut is neither pressed upon the sides of the saw, as must occur when lateral pressure is used, nor the block upon the teeth of the saws, as must occur when end pressure is made."

101. For an *Improvement in Corn and Cob Mills;* Daniel S. James, New Market, Virginia, Assignor to self J. B. White, and J. W. McIntire, Dinwiddie Co., Va.

Claim.—"I make no claim to any of the parts of the machine separately considered, neither do I claim the simultaneous rotation of shell and burr, nor the means by which the same is produced, as such is not new. But I do claim suspending the rotary shell by an upper arch upon a shoulder of the main spindle, when the said shell is connected at bottom with the burr, as described, and the moving power applied directly to the shell, whereby friction is greatly diminished and consequent facility of operation attained."

102. For a *Machine for Paging Books, &c.;* William C. Demain, Assignor to A. B. Ely, Boston, Massachusetts.

Claim.—"Operating the numbering wheels by means of the springs, whereby the first wheel is caused to actuate all the others, and the operation of the machine is rendered automatic, in the manner set forth. 2d, The repeating wheel operating according to the form and frequency of the notches therein, substantially as described. 3d, I claim the drum with its notches, in combination with the numbering wheels. 4th, The gate, in combination with the numbering wheels and the parts which set them in motion."

103. For a *Burglars' Alarm;* Albert Bingham, Assignor to self and Andrew J. Bailey, Boston, Massachusetts.

Claim.—"I do not claim combining with the match holder a roughened surface for the match to rub against, but I claim arranging the friction surface when applied to a spring, bent as set forth, at an angle with the match holder or its path of movement, as described, in order to facilitate the ignition of the match when the holder is in movement. I also claim making the friction surface to revolve, as described, in order that a fresh portion of the surface may be exposed to the match whenever any part of the surface becomes worn or unfit for use. I do not claim the combination of an alarm apparatus, a movable match holder or friction surface, and a lamp, nor the combination therewith of a contrivance for casting the extinguisher off the wick tube of the lamp; but I do claim, the above described arrangement of the match holder, cast-off lever, and hammer rod of the escapement, whereby, while the match holder is retracted, the escapement apparatus will be controlled as described, but during the forward motion of the match holder, not only will the cast-off lever be tilted, so as to throw the extinguisher off the wick tube, but the escapement set free, so as to enable the alarm mechanism to operate and strike the hammer with repeated strokes upon the bell."

104. For an *Improvement in Folding Chairs;* John Cram, Assignor to self and John S. Cram, Boston, Massachusetts.

Claim.—"Combining the platform or seat with the back legs by means of the turning or front legs, and the connecting links or bars, and so that said seat or platform may be either turned down horizontally, so as to be supported on both sets of legs, or they and the seat be folded together."

105. For an *Improvement in Harvesters;* Charles Bradfield, Philadelphia, Pa.

Claim.—"The arrangement of the pulleys on and near the axle, and the finger and cutter bar underneath the axle, when the cutters are operated from said pulleys through the intervention of the endless belt, cranks, pitman, and connecting rod, as set forth."

106. For an *Improvement in Curtain Rollers;* Dexter H. Chamberlain, West Roxbury, Massachusetts.

Claim.—"Attaching the spool directly to the spindle, and causing it to revolve with the curtain rod, where the spool is forced towards the jamb by the spring."

107. For an *Improvement in Window Shades;* John J. Crooke, City of N. Y.

Claim.—"So constructing and hanging a window shade, that the roller thereof shall be capable of being raised and lowered, and, at the same time, shall roll or unroll the shade, and this without interfering with the fixtures for raising the bottom of the shade in the ordinary manner, as described."

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108. For an *Improvement in Traps for Catching Animals;* Lucius B. Bailey, Watertown, Connecticut.

Claim.—"The application of the ratchet bar and pawl to the trap, for the purpose of rendering it capable of confining the animal after being caught underthe drop or fall, as set forth."

109. For an *Improvement in Cotton Gin Saws;* A. D. Brown, Columbus, Georgia, Assignor to Margaret L. Brown, Opalika, Alabama.

"This invention consists in arranging the teeth of the saws in a series of curves eccentric to their axes, or what is equivalent, in a series of tangential lines; by this means, with a proper arrangement of the saws relatively to each other, it is rendered impossible for any two saws to catch the same fibre across a rib, and thereby cut or break it, and a peculiar degree of facility is provided for the clearing of the saws by the brush."

Claim.—"I am aware that cotton gin saws have previously been constructed in segments of circles, but I regard that as a totally different arrangement, as the teeth are arranged in the same circle, and I do not claim any such arrangement; but I claim arranging the teeth in a series of curves eccentric to the axis of the saws, or what is equivalent, in a series of tangential lines, as set forth."

110. For a *Machine for Splitting Fire-Wood;* Wm. O. Bisbee, Camden, N. J.

Claim.—"I do not wish to confine myself to the exact form or method of operating the machine or to the exact number of vertical knives shown; but what I claim is, the vertical knives, as arranged with their edges a distance in advance of each other and their sides at different angles, so as to act effectually as a means of rifting wood."

111. For an *Improvement in Preparations of Wool Oil;* Thomas Barrows, Dedham, Massachusetts.

Claim.—"In basing my claim of invention or improvement on the use of mucilaginous matter, I do not include aluminous or gelatinous matter of animal origin, nor ammoniacal, or other alkaline emulsions which have been before used, but restrict myself to the use of those watery solutions of mucilage from plants and seeds, whose muculent character is distinguished from the gum or glue-like character of those substances heretofore used by not drying out from the mixture with the oil when on the fibres of the wool. I use any of the oils adapted to oiling wool in mixture with mucilage, although such mixture, by rest, for a longer or a shorter time, will become separated into oil, which floats, and mucilage which subsides, but prefer the prepared oleic acid or "oleine" mixture, as it often remains uniform several days. I, however, lay no claim to the application of oleic as described; but what I claim as my invention or discovery for the treatment and imbuing of wool, during or previous to its manufacture into yarn or cloth, is the application thereto of mucilage possessing an attraction for water, such being found in sea mosses and allied vegetable productions, or in various seeds, such as flaxseed, it being used either alone or in mixture with an oil or some other material."

112. For an *Improvement in Carriages;* John L. Cisco, Xenia, Ohio.

Claim.—"The application of the apparatus described in turning carriages short, consisting of the half circle bars or plates and sliding bar attached to the running gear, as described, in connexion with the fifth wheels, by which, in turning short, the body is carried out of the way of the wheels, in manner as described, or any other apparatus substantially the same producing the same effect."

113. For an *Improved Method of Facilitating the Removal of Incrustation from Steam Boilers;* Frederick P. Dimpfel, Philadelphia, Pennsylvania.

Claim.—"The method, substantially as described, of facilitating the removal of incrustation in steam boilers, by inducing breaks in the circle of the incrustation in the manner described."

114. For an *Improved Vise;* Robert W. and Daniel Davis, Yellow Springs, Ohio.

Claim.—"We are aware that parallel vises have been heretofore constructed with cross levers and ratchet movement, and do not claim merely such as our invention; but what we claim is, our improved arrangement of the sliding ratch beam, pawl, and the detachable weighted key, and the cam, all constructed and operated as described."

115. For an *Improvement in Harvester Rakes;* Oliver C. Green, Belleville, Ill.

"The nature of my invention consists in such an arrangement of the devices operating, and the mode of constructing a rake applicable to any of the harvesting machines now in use, that a side delivery of the cut grain shall be effected in the most simple and efficient manner by an apparatus free from complexity, extra weight, or waste of propelling power of the team employed."

Claim.—"I am aware that the delivery of grain at the right angles to the line of draft of the team has been accomplished by means of a rake traveling across the platform, in conjunction with a second rake turning in a segment of a circle, and, therefore, I do not claim the described delivery of grain irrespective of the means by which it is accomplished; but I claim the combination of the rake, sliding head, way or guide, fender board, and incline-plane, or severally of their equivalents, operating in the manner and for the purpose set forth, so that with a single rake, I accomplish the raking of grain across the platform and the delivery thereof in the manner substantially as set forth."

116. For an *Improved Sash Fastener;* Asahel Gilbert, Jr., Lowell, Massachusetts.

Claim.—"The hinged cross bars, having split knob handles, serving to disengage the fastening on both sides of the sash and to raise and lower the sash."

117. For a *Rotary Wood Splitting Machine;* G. W. B. Gedney, City of New York.

Claim.—"The machine described for splitting wood, consisting of the V grooved knives acting upon the wood, as described, having openings in their apex to receive the clearers, as specified, and in combination therewith, the fingers for holding down the rear end of the wood to be split. Also, the mode of attaching the knives by the groove, e', at their back, and an overreaching flanch, e'', by which the resisting strain tends to hold the knife in place, as specified, without bringing the strain upon the bolt by which it is fastened."

118. For an *Improvement in Ploughs;* John L. Gill, Columbus, Ohio.

"The nature of my invention relates to the construction of a plough, the mould board of which is of sheet, and the share, sheath, and land-side of cast iron, arranged and united as described."

Claim.—"I am aware that a combined steel and cast iron mould board has been used, and, also, that a cast standard has been used; these I do not claim, neither do I claim any of the parts used separately; but what I do claim as new, is a plough composed of a steel mould board, cast iron share, sheath, and land-side where the several parts are arranged as set forth."

119. For an *Improvement in Lime Kilns;* Daniel Herr, Pequea, Lancaster, Pa.

"The nature of my invention consists in so constructing permanent arches for lime kilns, that the fire may have free access to the limestone from beneath, and, at the same time, the loose lime and fragments, in falling through the grate ways of the arch, shall not fall upon and deaden the fire."

Claim.—"Making the arch of the kiln with two series of arched channeled ribs, so arranged, that the outer ribs shall extend over and across the spaces left between the inner ribs, and, at the same time, leave sufficient space between the outer and inner ribs for the fire and heat to pass into the limestone, whereby the fragments and loose lime are all prevented from falling into the fire, and are conducted down the channels into the proper receptacle below."

120. For an *Improved Hand Stamp;* Horace Holt, Winchester, Massachusetts.

Claim.—"A hand stamp, in which the stamp is inked and the impression effected by the movement of the stamp in one vertical plane, the ink pan or fountain being arranged directly under the stamp, and provided with a cover, which can be moved away from or upon the said pan or fountain, thus serving both as a cover to the ink receptacle and as a platen to the article to be printed."

121. For an *Improvement in Scythe Fastening;* Benjamin F. Joslyn, Worcester, Massachusetts.

Claim.—"The arrangement of the lever as applied to the hoop, as set forth, as a means of securing the shank of the scythe to the end of the snath."

122. For an *Improvement in Weighing Scales;* John L. McPherson, New Vienna, O.

Claim.—"I am aware, that various things have been made tubular or hollow for the purposes of strength with lightness of metal; this I do not claim; but what I do claim is, in combination with the shafts, the fifth or guard fulcra, which prevents the platform from careening should the weight be unequally distributed on said platform, without in the least impairing its correct weighing, as set forth."

123. For an *Improved Regulating Valve for Steam Engines;* E. G. Russell, Ravenna, Ohio.

"This invention consists in a valve of peculiar construction, which is acted upon by the pressure of steam, in such a manner as to cause the area of its opening to be increased or diminished by any tendency to diminished or increased velocity."

Claim.—"I do not claim to be the first inventor of a regulating valve, the area of whose opening is increased or diminished by any tendency of increased or diminished velocity; but what I claim is, the hollow cylindrical valve, open at one end and closed at the other, fitted in a cylindrical seat, with its closed end on the inlet side of the said seat, and provided with a slot at one side near the closed end, to allow the steam to pass through its interior, and having a spring applied to balance the excess of pressure on the inlet side, and to give a tendency to open the valve, the whole operating as described."

124. For an *Improvement in Sewing Machine Cases;* Francis A. Ross and Wm. H. Marshall, City of New York.

Claim.—"Making the case in the form of a cabinet, which, when opened, will afford space for operating the machine by the treadle, and will form a table for the work, by raising the leaves and supporting them by the doors of the cabinet, when thrown open, in the manner described. We, also, claim the construction of the folding top, which, when open, furnishes drawers and shelf for the convenience of the operator, as described."

125. For an *Improvement in Shutters or Blinds for Stores;* David Rohan, Cincinnati, Ohio.

"The nature of this invention consists in an arrangement of sliding shutters, which, in combination with a bolt column, can be used for shutting and closing stores or warehouses entirely or partially, as specified."

Claim.—"Hanging the shutters together by mitred joints, so that when closed, the joints or hinges may be concealed. Also, in connexion with the mitred shutters, the hinged piece, which serves the double purpose of a post against which said shutters abut and to which they may be locked when the front is closed, and also as a finish to one of the shutters when it is run back, as represented."

126. For a *Machine for Trimming Books;* M. Riehl, Cincinnati, Ohio.

"The nature of my invention consists in the peculiar mode of hanging the knife and the mode of operating the same."

Claim.—"Hanging or attaching the knife to the cross piece of the uprights by the arms, as shown, whereby a drawing or oblique cut of the knife is obtained, and operating the knife by means of the worm wheel, screw, and connecting bar."

127. For an *Improvement in Brick Machines;* Levi Till, Sandusky, Ohio.

Claim.—"1st, The use of the air pump in combination with the perforated pressers, by which the air is exhausted from the clay while under pressure, as stated, and not otherwise. 2d, The device of the diagonal slots, in combination with alternating with the pressers, by which all the excess of clay may escape, and is discharged on one side (and not on both) of the machine."

128. For an *Improvement in Wagons;* James Parsons, Dublin, Indiana.

Claim.—"1st, The arrangement of the side pieces or ways resting upon the elevating blocks near the outer end of the bolster, thereby gaining a greater width between them than is attained in other wagons constructed for similar purposes, thus giving space for loading, if raised on a plank or platform, to raise partly above and between them, if necessary, to clear the ground in hauling; also, the manner of their forming the connexion between the forward and hind wheels, by passing or sliding through the brace bands and the mortises or slots of the arch. 2d, In the structure of cast arch, the open mortises or slots and their uses, that when the arch and wrought axle-tree combined, as represented, when supported by the hind wheels, the mortises or slots will be brought nearly or quite in a horizontal position for the reception of the side pieces or ways, as described, thus serving the purposes of coupling the wagon long or short, to suit circumstances. 3d, The peculiar adaptation of the oblong band of the braces, through which the side pieces or ways slide and the hind elevating blocks pass, and the blocks being held in their proper position by the bands dropping into the notches of elevating blocks, thus giving them the sliding motion upon the side pieces or ways, and the side pieces or ways are permitted to slide freely through them and under the blocks, and from thence they form a connexion with the cast arch and wrought axle-tree by a stirrup firmly binding them together. 4th, Also the manner of so arranging the hind elevating blocks, as to give them the sliding principle, as previously described, and the ears on opposite sides, thus rendering them adjustable in coupling the wagon long or short, by means of the steady or toggle pins, and, again, by their holding in connexion with the braces, the arch in a perpendicular position, by the upper part of the casting of mortises or slots being notched into the elevating blocks as described."

129. For an *Improvement in the Mechanism for Changing Harvesters from Reapers to Mowers, &c.;* Robert Beans, Johnsville, Pennsylvania.

Claim.—"The combination of the lever and connecting rod with any means of altering the height of the frame above the cutter bar, for the purpose of retaining the same relations between the stroke of the knives and the teeth or fingers, although the distance between the head of the cutter bar and the crank be varied in so doing, as set forth."

130. For an *Improvement in Machines for Cutting Standing Cotton Stalks;* S. Bowerman, Detroit, Michigan.

Claim.—"The combination of the block, knife, rods, springs, rack, and cog-wheel, when arranged for the purposes specified and shown."

131. For an *Improvement in Ships' Windlasses;* James Emerson, Worcester, Mass.

Claim.—"The gearing and the ratchet on the shaft, when arranged substantially as shown, for the purpose of operating the shaft of the windlass with a quick, or slow, or vibrating motion, and with a corresponding degree of power, one set of gear wheels being independent of the other set, and allowing the windlass, in case of the breaking of one, to be operated by the other."

132. For an *Improvement in Breech Loading Fire Arms;* Benjamin F. Joslyn, Worcester, Massachusetts.

Claim.—"The combining of the cone-headed pin and two or more expanding rings with the radial breech loading fire arms."

133. For an *Improvement in Grain and Grass Harvesters;* John Thompson Clifton, City of New York.

"My invention consists in the extension of the axle in reaping machines across the machine at such height, that the grain or grass may be gathered and discharged under the axle."

Claim.—"Discharging the grain from the platform between the platform and the driving wheel and under its axle, when the same is done in connexion with a pair of wheels whose axle extends across the machine, as described."

134. For an *Improvement in Straw Cutters;* John A. Thompson, Cayuga, N. Y.

Claim.—"Giving the cutting disk of a straw cutter a combined rotary and reciprocating motion, in the manner set forth."

135. For an *Improved Collapsible Boat;* Nathan Thompson, Jr., Williamsburgh, N. Y.; patented in England, February 23, 1855.

Claim.—"1st, The combination of hinged flaps or bottom pieces with elastic or flexible sides, in the manner and for the purposes specified. 2d, The combination of hinged flaps with a centre keelson and flexible or elastic sides, as set forth. 3d, I claim either of these combinations in connexion with water-proof fabric for closing and securing the joints between the several parts, applied substantially as specified. 4th, I claim a hinged swinging brace, in combination with a hinged thwart thereto attached, and, lastly, I claim a sliding joint, in combination with the bow and stern hinges, whereby the effective length of a keelson or flaps may be altered, so as to suit the expanded and collapsed states of the boat."

136. For a *Machine for Cutting Irregular Forms;* P. H. Wait, Barkersville, N. Y.

Claim.—"I do not claim the pattern or the means of turning irregular formed articles by means of a pattern, for this has been previously done in various ways; but what I claim is, the employment or use of two vibrating or oscillating frames, placed upon a rod or shaft and operated by means of the pattern bearing against the sliding rollers or disks, said pattern, as it rotates, moving the 'stuff' at the upper parts of the frames towards and from the cutter disk, the cutter disk and rollers or disks being moved by means of the screw-rod or shaft and nut, as shown."

137. For an *Improvement in Reaping and Mowing Machines;* Henry Waterman, Williamsburgh, New York.

Claim.—"I do not claim the advancing and retreating curvilinear motion of the cutter bar, but I claim the combination of the two sets of knives described with the curvilinear motion of the cutter bar. Also, the elastic fingers, in combination with the curvilinear motion of the cutter bar. Also, collecting and depositing the grain by the revolving cradles by the weight of the grain laid upon them by the reel."

138. For an *Improvement in Vault Lights;* Wm. P. Walter and Jacob Green, Philadelphia, Pennsylvania.

Claim.—"We are aware, that it is a very common device to avail one's self of the expansive and contracting properties of metal in fitting metal rims tightly around various articles, and we are also aware that it is not a new device to unite silicious compounds to metal by casting the former, in a molten state, about the latter, as, for instance, in the manufacture of porcelain or glass door knobs with metal shanks; we, therefore, disclaim both of these as broad devices. But what we do claim is, the described improvement in the construction of vault lights, namely, casting the molten glass directly into the metal frame while in a heated state, said metal frame being grooved internally, so that when it contracts on cooling, and contracting as it does, more than the glass, this groove shall bind the glass lens tightly in its place and so retain it."

139. For an *Improved Flask for Moulding Bath Tubs;* John Demarest, Assignor to "The J. L. Mott Iron Works," Mott Haven, New York.

Claim.—"Connecting, by means of a brace or braces, the sides of the drag or first section, and of the cope or third section of flasks, for casting bath tubs or other large and thin hollow vessels, substantially as described, in combination with the clamps and adjusting screws, or their equivalents, which embrace and act upon the sides of the cheek or second section of the flask. And, also, recessing the upper edge of the wings on the inside of the cheek or second section of the flask back of the inner edge, as specified."

140. For an *Improvement in Ink-Stands;* Albert Bingham, Assignor to self and Andrew J. Bailey, Boston, Massachusetts.

Claim.—"Arranging and combining with the hinged cover of the pen port, substantially as described, the bow lever, whereby the cover may be raised, under circumstances and in the manner specified."

RE-ISSUES FOR AUGUST, 1855.

1. For an *Improvement in Hot Water Apparatus;* John Brown, City of New York; patent dated May 30, 1854; re-issue dated August 14, 1855.

Claim.—"Connecting the ends of the horizontal or nearly horizontal water pipes of hot water warming apparatus, by means of return bends or elbows of less calibre, and entering within the end or ends of such pipe or pipes. Also, making each horizontal or nearly horizontal pipe having the bend or elbow at one end of reduced calibre with the calibres at top in the same line, whether made in one piece or the bend or elbow separate and then united, the said elbow being connected with the next pipe above it by entering the end thereof. And I claim the construction and arrangement of the apparatus for the purpose as specified."

2. For an *Improvement in Bathing Tubs;* Jordan L. Mott, Mott Haven, New York; patent dated September 27, 1853; re-issue dated August 14, 1855.

Claim.—"I do not claim broadly as of my invention the connexion of the hot and cold water pipes of a vessel, so as to discharge hot and cold water together, as this has before been done by a pipe or pipes coupled with the bottom of the vessel and discharging upwards; nor do I claim broadly the use of an overflow pipe for carrying off the water and preventing the water in the tub from overflowing, as a separate device has before been used for this purpose, but, when so used, it was so connected with the waste and supply pipes, as to necessitate the use of a valve within the water pipe or a double coupling therewith, together with all its attendant disadvantages. And, although I have described my said improvements in connexion with and as applied to a bath tub, it will be obvious, from the foregoing, that they are equally applicable to other and analogous vessels, such as wash-basins, wash-tubs or vats, sinks for kitchens, &c. What I claim is the before described mode of combining with a bathing tub or other like vessel, either one or both of the channel ways, and making part of the tub or vessel (when constructed) one of which channel ways connects the overflow and waste or discharge holes with the waste pipe, and the other channel way is adapted to the insertion of the hot and cold water pipes, and discharging the hot and cold water together at or near the bottom of the vessel and in a horizontal or nearly horizontal direction."

3. For a *Method of Warming and Ventilating Buildings;* Henry Rutland, Coburg, Canada West.

Claim.—"1st, The mode herein described of warming and ventilating buildings, railroad cars, and apartments of every known description, the same consisting in introducing the air from without, by conducting under the floor of the building or apartment and directly under the air warmer or ventilator, for the purpose of being warmed for distribution, the air after being thus warmed, rising in a central or otherwise convenient apartment or passage, and thence being admitted into the various rooms of the building or into the apartment near the ceiling or roof, without the aid of pipes, and thence passing downwards and through openings in the lower part of the rooms or apartment, and thence outwards through the various channels provided, connected with the foul air shaft. I do not claim simply introducing warm air at the top of a room and discharging it at the bottom, but only intended to claim this when effected in the manner as above described. 2d, The arrangement of the radiating pipes or flues of the air warmer, in combination with the fire chamber situated within or between them. 3d, In combination with the elevated air chamber and flues of the air warmer, the arrangement of the openings for admitting heated air above the fire to complete combustion. 4th, The construction of the fire grate, viz: with one or more grates of cylindrical or other form raised above the ordinary grate-floor, said raised grates being capped or covered in such manner, as to protect the vertical bars from the fuel. 5th, The mode of conducting the air into the pure air-shafts, whatever may be the direction of the wind or of the external currents of air, by placing a swinging valve or shutter at the mouth of said shafts. 6th, So constructing or placing the mouths of the pure air-shafts for the ventilation of railroad cars, that by the motion of the car, the incoming pure air may be increased in quantity."

4. For an *Improvement in Lanterns;* Hugh Sangster and James Sangster, Buffalo, New York; patent dated June, 10th, 1851; re-issue dated August 21st, 1855.

Claim.—"We do not claim fastening lamps to lanterns by spring catches, nor do we claim attaching said catches to the upper part of the lamp and extending them down, so as to spring outward over a flanch in the lantern; but we do claim constructing and arranging the spring catches to cause the attachment of the lamp to the lantern by the operation of pressing the lantern down upon the spring catches. Also, arranging the thumb piece within the flanch at the base of the lamp by extending the springs towards each other horizontally, and thus forming the elbow-catch to rest against the shoulder on the flanch of the lantern."

5. For a *Method of Closing and Opening Gates;* Wm. G. Phillips, Newport, Delaware; patent dated March 7, 1854; re-issue dated August 21, 1855.

Claim.—"A double span rotating gate, opening and closing by an intermittent rotating motion in one direction only, said motion being derived through lifting pieces or levers, cam planes, weights, or cords, or their equivalent."

6. For an *Improvement in Hinges;* Charles Parker, Meriden, Connecticut, Assignee of Wm. Baker, Utica, New York; patent dated April 13, 1852; re-issue dated August 28, 1855.

Claim.—"I do not claim as new, simply constructing the window blind hinge with its screw plate, so arranged as to be screwed to the back of the blind and the outside of the window-casing, but I claim the bridge or inclined plane at the base of the pin, and the corresponding elongation of the eye operating and in connexion with the hook and catch attached and connected in the manner described. Also, the elongated or enlarged eye, independently of its combination with the bridge, for giving the lateral motion to the blind to effect the disengagement of the lower catch. Also, so placing the catches on the two ports of the hinge, as to cause the strains produced by the wind or otherwise, to act directly upon the screws, whereby the pin and eye are relieved."

Designs for August, 1855.

1. For *Labels on Bottles and Jars;* Wm. A. Rogers, Decatur, Alabama; August 7, 1855.

Claim.—"The construction of the design and the fashioning of the letters and the marking out of the same, so as to leave them on the glass in a permanent form."

2. For *Ornamenting Stove Plates;* Samuel W. Gibbs, Albany, New York, Assignor to A. H. McArthur & Co., Hudson, New York; August 14, 1855.

Claim.—"The combination and arrangement of ornamental figures and forms represented in the accompanying drawings."

3. For *Cooking Stoves;* Apollos Richmond, Assignor to A. C. Barstow & Co, Providence, Rhode Island; August 21, 1855.

Claim.—"The design, consisting of the ornamental plan and scolloped mouldings and figures of harps or ancient lyres."

4. For *Iron Railings;* Minard H. Fowler and Enoch Jacobs, Cincinnati, Ohio.

Claim.—"The ornamental design and configuration of looped bars and rosettes, balls and pickets."

5. For *Stoves and Fire-Places;* Winslow Ames, Nashua, New Hampshire; August 28, 1855.

Claim.—"The ornamental design as exhibited in the accompanying drawings, or more particularly, that of the front plate and the end plate, the hearth plate, the leg, the top plate, and the blower."

6. For *Cooking Stoves;* Russell Wheeler and Stephen A. Bailey, Utica, New York; August 28, 1855.

Claim.—"The configuration of surface and combination of ornaments."

7. For *Portable Fire-Places;* Winslow Ames, Nashua, New Hampshire; August 28, 1855.

Claim.—The design of the front of the stove, or, more particularly, that of the urn, the front plate, the upper blower, the fender, and the lower blower."

8. For *Cooking Stoves;* Conrad Harris and Paul Wm. Yoiner, Cincinnati, Ohio, Assignors to A. Bradley, Pittsburgh, Pennsylvania; August 28, 1855.

Claim.—"The design of the ornaments on the several parts of the cooking stove."

MECHANICS, PHYSICS, AND CHEMISTRY.

On the means of Realizing the Advantages of the Air-Engine. By William John Macquorn Rankine, Civil Engineer, F.R.SS. Lond. and Edin., &c.*

[Read to the British Association for the Advancement of Science, Section G, at Liverpool, September, 1854.]

Section I. Summary of the Laws of the Mutual Relations of Heat and Mechanical Power, and of the Theoretical Efficiency of Thermo-Dynamic Engines.

1. The principal object of this paper is to explain the advantages of certain improvements in air-engines, and the reasons for believing that, with these improvements, such engines will be found to be the most economical means of developing motive power by the agency of heat. For this purpose, it is necessary, in the first place, to state briefly the general principles which have been established by the joint agency of reasoning and experiment respecting the mutual relations of heat and motive power, and which are applicable to steam, air, and all substances whatsoever.

It is a matter of ordinary observation, that heat, by expanding bodies, is a source of mechanical power, and conversely, that mechanical power being expended either in compressing bodies, or in producing friction, is a source of heat.

The general rules according to which these phenomena take place, have for some time been determined empirically, with more or less precision, for certain particular substances—for example, for steam ; but all systematic knowledge respecting them, as they affect all substances whatsoever, is deducible from two laws—that of the mutual convertibility of heat and mechanical power, and that of the efficiency of thermo-dynamic engines ; the term *thermo-dynamic engine* being used to denote any body, or assemblage of bodies, which produces mechanical power from heat.

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* From the Edin. Philos. Jour., January, 1855.

2. THE LAW OF THE MUTUAL CONVERTIBILITY OF HEAT AND MECHANICAL POWER is this : *That when mechanical power is produced by the expenditure of heat, a quantity of heat disappears bearing a fixed proportion to the power produced; and conversely, that when heat is produced by the expenditure of mechanical power, the quantity of heat produced bears a fixed proportion to the power expended.*

This law was believed, and reasoned from, by some inquirers before it was proved by experiment; but being inconsistent with the formerly prevalent hypothesis of the existence of a peculiar substance as the cause of the phenomena of heat, it was recognised by few, until Mr. Joule, by experiments on the production of heat by the friction of the particles of various substances, solid, liquid, and gaseous, not only demonstrated the mutual convertibility of heat and mechanical power, but ascertained the fixed proportion which they bear to each other in cases of mutual conversion, which is this : The *unit of heat* generally employed in Britain—that is to say, so much heat as is sufficient to raise the temperature of *one pound of water*, at ordinary temperatures, by *one degree of Fahrenheit's thermometer*—requires for its production, and produces by its disappearance, in other words, is *equivalent to*, 772 *foot-pounds of mechanical power;* that is to say, so much mechanical power as is sufficient to lift a weight of one pound to a height of 772 feet.*

This quantity is known by the name of *Joule's equivalent*, and may be otherwise termed the *dynamical specific heat of liquid water* at ordinary atmospheric temperatures.

3. *Illustrations of this law.*—The dynamical specific heats of other substances may be determined either by direct experiment, or by ascertaining their ratios to that of water. For example, to heat one pound of atmospheric air, maintained at a constant volume, by one degree of Fahrenheit, requires the expenditure of

130·5 foot-pounds of mechanical power. †

This is the *real dynamical specific heat* of air. The *apparent dynamical specific heat* of one pound of air, *under constant pressure,* is (for a degree of Fahrenheit)

183·7 foot-pounds ; †

the difference, or 53·2 foot-pounds, being the mechanical power exerted by the air in expanding, so as to preserve the same pressure, notwithstanding the increase of its temperature by one degree. The apparent specific heat of air at constant pressure exceeds the real specific heat in the ratio of 1·41 : 1.

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* The value of Joule's equivalent for a degree of the centigrade scale is 772 × 9-5 = 1389·6 foot-pounds. For French measures, viz., centigrade degrees, kilogrammes, and metres, it is 423·54 kilogrammetres. See Philosophical Transactions, 1850.

† It is worthy of remark, that the values of the specific heats of air were *predicted,* to a close approximation, by means of the Mechanical Theory of Heat, three years before they were ascertained by M. Regnault's experiments. (Trans. Roy. Soc. Edin., vol. xx.; Comptes Rendus, 1853.)

All quantities of heat may be thus expressed by equivalent quantities of mechanical power. The heat required to raise one pound of liquid water from the freezing to the boiling point, and to evaporate it at the latter temperature, is

$$1147°{\cdot}5 \times 772 = 885{,}870 \text{ foot-pounds,}$$

of which $180°{\cdot}0 \times 772 = 138{,}960$ foot-pounds is what is termed *sensible heat*, or the heat employed in raising the temperature of the water, while the remainder,

$$967°{\cdot}5 \times 772 = 746{,}910 \text{ foot-pounds,}$$

is the *latent heat of evaporation* of one pound of water at 212° Fahr., being the heat which disappears in overcoming the mutual attraction of the particles of water, and the external pressure under which it evaporates.

The mechanical equivalent of the available heat produced by *one pound* of such kinds of coal as are commonly used for engines in Britain may be taken on an average as equal to that of the heat required to raise *seven pounds of water* from the temperature of 50° to 212° Fahr., and to evaporate it at the latter temperature; that is to say, in round numbers,

$$6{,}000{,}000 \text{ foot-pounds.}$$

The total heat produced by the combustion of the coal is considerably greater; but a portion necessarily escapes with the gases which ascend the chimney, and the above may be considered as a fair average estimate of the mechanical equivalent of that which is practically available.

4. *Mechanical Hypothesis respecting Heat.*—Heat, being convertible with mechanical power, is convertible also with the *vis-viva* of a body in motion. The British unit of heat, one degree of Fahrenheit in a pound of liquid water, is equivalent to the *vis-viva* of a mass weighing one pound, moving with the velocity of 223 feet per second, being the velocity acquired in falling through a height of 772 feet. A mass of water, of which each particle is in motion with this velocity, has its temperature elevated by one degree of Fahrenheit, upon the extinction of the motion, by the mutual friction of the particles.

It is natural to suppose that the motion, during this phenomenon, has not been really destroyed, but has been converted into revolutions of the particles in vortices or eddies too small to be perceptible by any of our modes of observation; and that the centrifugal force of such eddies is the cause of the tendency of hot bodies to expand, melt, and evaporate.

A hypothesis of this kind has long been entertained, and within the last few years it has been used so as to deduce the laws of the mechanical action of heat from the principles of ordinary mechanics, to a certain extent in anticipation of the results of experiment.* As those laws, however, have now been exactly ascertained by experiment, it must be borne in mind, that their certainty is in no way dependent on the truth of the hypothesis in question; the probability of the hypothesis being, on the contrary, dependent on the truth of the laws.

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* See Transactions of the Royal Society of Edinburgh, vol. xx.

5. *Three-fold effect of Heat.*—The communication of heat to a substance produces, in general, three kinds of effects (setting aside chemical, electrical, and magnetic phenomena, as being foreign to the subject of the present paper):—

1st. An increase of temperature and expansive pressure; that is to say, an increased tendency to the communication of heat to other bodies, and to the development of mechanical power by expansion.

2d. A change of volume; which, under a constant pressure, is an *increase* for every substance, except some liquids near their freezing points.

3d. A change of molecular condition; as from the solid to the liquid state, or from the liquid or solid to the gaseous state, or any imperceptible change of molecular arrangement; the change to the gaseous state being always accompanied by an increase of volume.

The heat which produces the first of those effects is known by the name of *sensible heat*, as retaining the form of heat, and, in short, *making the body hotter.*

The heat which produces the second and third of those effects is called *latent heat*, as having disappeared in developing a mechanical effect, and being capable of reproduction by reversing the change which caused it to disappear.

Changes of volume are in general accompanied by changes of molecular arrangement or condition, perceptible or imperceptible. The *latent heat of expansion*, or of *evaporation*, therefore, as the case may be, consists partly of heat which disappears in overcoming external pressure, and partly of that which disappears in overcoming the mutual attraction of the particles of the body.

The latter forms by far the greater part of the *latent heat of evaporation.* For example, as already stated, there disappears, in evaporating one pound of water at 212°, a quantity of heat equivalent to . . . . . 746,910 foot-pounds.

The pressure of the steam produced is 2116·4 lb. on the square foot. Its volume is not known exactly by experiment, but is probably about 26½ cubic feet more than that of the liquid water. Multiplying these two quantities together, it appears that the heat expended in overcoming external pressure is equivalent to only . . . . 56,085 "

leaving . . . . . 690,825 "

for the mechanical equivalent of the heat which disappears in overcoming the mutual attraction of the particles of the water.

On the contrary, the latent heat of expansion of a permanent gas consists almost entirely of heat which disappears in overcoming the external pressure, that which disappears in overcoming the mutual attraction of the particles of the gas being comparatively very small; in fact, in all practical calculations respecting air-engines, the latter quantity may be altogether neglected without sensible error, and the latent heat of expansion of the air treated as the exact equivalent of the mechanical work performed by it in the act of expanding.

For example,—the product of the volume, in cubic feet, of one pound of air, at the temperature of 650° Fahrenheit, by its pressure in pounds per square foot, is 59,074 foot-pounds. If that pound of air be expanded under pressure, to 1½ times its original volume, and be still maintained at the constant temperature of 650°, by being supplied with heat from an external source, the work performed by it in expanding, will be 59,074 × hyperbolic-logarithm of 1½ = 23,953 foot-pounds; and this quantity will also be sensibly equal to the mechanical equivalent of the heat supplied, and which disappears during the expansion.

In considering the performance of any thermo-dynamic engine, it is evident that the heat which disappears in producing increase of volume under pressure, is to be regarded as the real source of power; as it is a portion of this heat which is actually converted into mechanical work, while the heat expanded in producing elevation of temperature, produces merely a *tendency* to the development of power.

6. *Mode of Operation of Thermo-dynamic Engines in general.*—The mode of operation of an elastic substance in performing mechanical work by the agency of heat, reduced to its simplest form, consists in the continued repetition, either upon the same portion of the substance, or upon a succession of equal and similar portions, of a cycle of four processes, which, taken together, constitute a single stroke of the engine.*

Process A. The substance is raised to an elevated temperature. This process may or may not involve an alteration of volume.

Process B. The substance, being maintained at the elevated temperature, increases in volume and propels a piston, or something equivalent to a piston. During this process heat disappears, and a supply of heat from without is provided equal in amount to the heat which disappears; so that the temperature does not fall.

Process C. The substance is cooled down to its original low temperature. This process, like the process A, may or may not be accompanied by a change of volume.

Process D. The substance, being maintained at its depressed temperature, is compressed, by the return of the piston, to its original volume. During this process, heat is produced; and in order that it may not elevate the temperature of the substance, and give rise to an increased pressure, impeding the return of the piston, it must be abstracted as quickly as produced, by some external means of refrigeration.

The substance, being now brought back to its original volume and temperature, is ready to undergo the cycle of processes anew, and so on *ad infinitum*; or otherwise, it is rejected, and a fresh portion of the substance employed for the next stroke. When the latter is the case, the operation of expelling the substance from the engine into the atmosphere, by the return of the piston, sometimes takes the place of the process D.

Sometimes, either of the processes, B, C, or D, is the first in the order of time. The cycle of processes, however, preserves the same order of rotation.

During the cycle of processes which has been described, the working substance alternately increases and diminishes in volume, in contact with a moving piston. During the increase of volume, the pressure of the substance against the piston communicates to the latter mechanical power. During the diminution of volume, on the contrary, the piston expends mechanical power in compressing the working substance. The increase of volume takes place at a higher temperature, and therefore at a higher pressure, than the diminution of volume; consequently, the mechanical power communicated to the piston, exceeds that taken away from it. The surplus is the power of the engine, available for performing mechanical work.

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* This cycle of processes was first described by Carnôt (Reflexions sur la puissance motrice du feu); but his conclusions were vitiated by the assumption of the substantiality of heat.

7. *Efficiency of Thermo-dynamic Engines.*—The efficiency of a thermo-dynamic engine is the ratio which the available power bears to the mechanical equivalent of the whole heat expended.

If it were possible to construct an engine such, that the heat communicated to the working substance should entirely disappear, the power produced by that engine would be the exact equivalent of the heat expended: that is to say, 772 foot-pounds for each British unit of heat; and its efficiency would be represented by unity. According to the average estimate already stated, it would produce power to the amount of 6,000,000 foot-pounds for each pound of coal consumed; and, as a horse-power is 1,980,000 foot-pounds per hour, the consumption of coal would be 0·33 lb. per horse-power per hour. It is impossible, however, by any engine, to realize anything approaching to this degree of efficiency. This arises from two causes:—*first*, the *necessary loss* of heat, depending on the limits of temperature between which the engine works, according to a law which has been already referred to, and which will shortly be stated; and, *secondly*, the *waste* of heat and power arising from the engine's not fulfilling exactly the conditions prescribed by theory. When the *necessary loss* of heat alone is taken into account, the efficiency as determined by calculation, may be called the *Theoretical Maximum Efficiency* of the kind of engine under consideration. When the *waste* of heat and power is also allowed for, the result is the *actual efficiency* of the engine.

8. *Theoretical Conditions of Maximum Efficiency.*—The latent heat of increase of volume at an elevated temperature, being the direct source of the power of a thermo-dynamic engine, it is obvious, that, *cæteris paribus*, the more we reduce the other part of the expenditure of heat, namely, the heat which is expended in elevating the temperature of the working substance, the more nearly shall we attain to the maximum theoretical efficiency of the engine. It is theoretically possible to produce the required elevation of temperature, without any expenditure of heat. This is to be accomplished in two ways:—either by elevating the temperature of the substance by compression during the process A of the cycle: the power required for effecting such compression being obtained, during the process C, by depressing the temperature of the substance entirely by expansion; or otherwise, by storing up in a mass of some solid conducting material (called an economizer or regenerator,) the heat given out by the working substance, while its temperature is being depressed, during the process C, and employing the heat, so stored up, to produce the required elevation of temperature during the process A. This method of economizing heat was invented in 1816, by the Rev. Robert Stirling.

By one or other of those methods, it is theoretically possible to limit the expenditure of heat in a thermo-dynamic engine to that amount which disappears during the process B of the cycle, in producing increase of volume at an elevated temperature. The heat which reappears during the process D, by the compression of the working substance at a low temperature, and which is carred away by refrigeration, constitutes the *necessary loss of heat;* and, if this be deducted from the whole heat expended, the remainder will be the theoretical maximum value of the heat which is permanently converted into mechanical power, and its ratio to the whole heat expended will be the theoretical maximum efficiency of the engine.

9. *Absolute Temperatures.*—The theoretical maximum efficiency of a thermo-dynamic engine, depends upon what are called the *absolute temperatures* of the working substance, during the second and fourth processes of the cycle; that is to say, the absolute temperatures at which heat in a theoretically perfect engine is received and abstracted respectively. Absolute temperatures are measured by the product of the pressure and volume of a given weight of a given perfect gas. A perfect gas is one in which the mutual attraction of the particles is insensible.

The *Absolute Zero of Heat* on a perfect gas thermometer, is that point on its scale which corresponds to total absence of heat; and from this point, absolute temperatures are understood to be reckoned, in the law stated in the next article.

According to the latest determination, from the experiments of Messrs. Joule and Thomson, the *Absolute Zero of Heat* does not differ by any amount appreciable in practice from the *Absolute Zero of Pressure*, being the temperature at which (if it were possible for a perfect gas to preserve its properties at so intense a degree of cold) the product of its pressure and volume would be reduced to nothing; and this point is 493° of Fah. below the temperature of melting ice; that is to say, 493°—32°= 461° below Fahrenheit's ordinary zero.*

10. THE LAW OF THE MAXIMUM EFFICIENCY OF THERMO-DYNAMIC ENGINES is expressed by the following proportion:—

As the absolute temperature of receiving heat
is to the difference between the absolute temperatures of receiving and discharging heat,
so is the whole heat received
to the portion of heat permanently converted into mechanical power;

that is to say,

so is unity to the efficiency of the engine.

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* The product of the volume in cubic feet of one pound of atmospheric air, by its pressure in pounds on the square foot, at the temperature of melting ice, is 26,214 foot-pounds. The corresponding product, at any other temperature, is found with a degree of accuracy sufficient for practical purposes, by multiplying the absolute temperature by $\frac{26{,}214}{493} = 53{\cdot}172$ foot-pounds per degree of Fahrenheit. In the detailed investigations already referred to, the absolute zeros of heat and of pressure have had various positions assigned to them as the most probable, within a range of about 4° Fahrenheit, according to the degree of precision of the experimental data, existing at the periods when the several papers were written. This range of variation, however, is not sufficient to cause any error of practical importance in calculations respecting engines.

This proportion may be otherwise expressed, as follows:—

As the absolute temperature of receiving heat
is to the absolute temperature of discharging heat,
so is the whole heat received
*to the necessary loss of heat.**

To illustrate the above law, the following table is added, showing four examples of the efficiencies of theoretically perfect engines working between limits of temperature, to which there will be occasion to refer in the sequel: the 7th column shows, in each case, the maximum theoretical duty of a pound of coal, supposing, as before, that the whole available heat of its combustion is equivalent to 6,000,000 foot-pounds: the 8th column shows, for each example, the corresponding minimum theoretical consumption of coal per horse-power per hour: the limits of temperature chosen in the five examples are respectively as follows:—

(1.) The limits of temperature for a condensing steam engine, with a pressure of 42 lbs. per square inch in the boiler, and 2·9 lbs. per square inch in the condenser: (in every instance in this paper in which a pressure is mentioned, it is to be understood to mean the *total pressure*, and not the *excess* above the pressure of the atmosphere.)

(2.) The limits of temperature for a non-condensing steam engine with a pressure of 153 lbs. per square inch in the boiler.

(3.) A probable estimate of the limits of temperature of Ericsson's air engine of 1852.

(4.) The same for Stirling's air engine, and also for that of Napier and Rankine.

The actual efficiency of these engines will be considered in another part of this paper.

Examples of Maximum Theoretical Efficiency.

Nos of Examples.	Temperatures in Degrees of Fahrenheit.				Maximum theoretical Efficiencies.	Maximum theoretical Duties of one pound of Coal, ft.-lb.	Minimum theoretical Consumption of Coal per horse-power per hour, lb.
	Ordinary.		Absolute.				
	Higher.	Lower.	Higher.	Lower.			
1	270	140	731	601	$\frac{130}{731}=0{\cdot}178$	1,067,000	1·86
2	360	212	821	673	$\frac{148}{821}=0{\cdot}180$	1,080,000	1·83
3	480	100	941	561	$\frac{380}{941}=0{\cdot}404$	2,424,000	0·82
4	650	150	1111	611	$\frac{500}{1111}=0{\cdot}450$	2,700,000	0·73

In order to show the manner in which the pressure and volume of elastic substances vary, in producing the maximum theoretical efficiency of a thermo-dynamic engine, so as to verify in every case the general law, a supplement is added to this section, containing detailed computations for three examples of theoretically perfect engines: viz., a steam engine working between 270° and 140°, an air engine working between the same temperatures, and an air engine working between 650° and 150°.

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* There are other forms in which this law might be expressed; but those stated above are the most readily applicable to the performance of engines worked by heat, and are therefore to be preferred in a paper such as the present. See Trans. Royal Soc. Edin., Vol. xx. (1850 to 1853,) and Phil. Trans., 1854.

Carnôt was the first to perceive, that the maximum effect of the expenditure of a given quantity of heat in a thermo-dynamic engine must be a function of the temperatures of receiving and discharging heat: but the hypothesis of the substantiality of heat misled him as to the nature of the function.

11. As the law above stated is true for all substances whatsoever in all conditions, it is obvious that, in a purely theoretical point of view, the only reason for preferring any one substance to another, as the agent in converting heat into mechanical power, is the greater ease and safety of causing it to expand by heat at a high temperature. In this point of view, permanent gases are preferable to vapors rising from liquids; for the density of a permanent gas can be regulated at pleasure so as to limit its pressure at any temperature, how elevated soever, to a safe and manageable amount; whereas, a given vapor, while in contact with its liquid, has but one possible density for each given temperature, and consequently but one possible pressure; and as the pressures of the vapors of all easily obtainable fluids increase very rapidly with the temperature, it would be unsafe to use vapors at temperatures at which it is safe and easy to use permanent gases. For example, at the temperature of 650° Fahr. (measured from the ordinary zero,) a temperature up to which air engines have actually been worked with ease and safety, the pressure of steam is 2100 pounds upon the square inch; a pressure which plainly renders it impracticable to work steam engines with safety at that temperature.

Supplement to Section I.—A. *Example of the computation of the power produced by the combustion of one pound of coal in a theoretically perfect Steam Engine, working between the temperatures of* 270° *and* 140° *of Fahrenheit.*

Data.—Mechanical equivalent of the whole available heat obtained by the combustion of 1 lb. of coal, 6,000,000 ft.-lb.

	In Boiler.	In Condenser.
Temperatures (ordinary scale), .	270° Fahr.	140°
Absolute Temperatures, .	731 "	601
Pressures,	lb.	lb.
Per square inch, . . .	41·93	2·89
" foot, . . .	6038·	415·7
		Cubic feet.
Volume of one pound of steam in the boiler, . .		9·852
Latent heat of evaporation of one pound of steam (mechanical equivalent), . . .		ft.-lb. 715,800

Computation of the maximum theoretical duty of one pound of coal by the general law.

$$\text{Theoretical maximum efficiency, } \frac{270^\circ - 140^\circ}{731^\circ} \quad \frac{130^\circ}{731^\circ} = 0{\cdot}178$$

Duty of one pound of Coal, $\frac{130}{731} \times 6{,}000{,}000 = 1{,}067{,}000$, as in Example I. of the table in article 10.

Computation of the maximum theoretical duty of one pound of coal, introducing the changes of pressure and volume undergone by the Steam.

Water evaporated by one lb. of coal,

$$=\frac{\text{available heat of combustion}}{\text{latent heat of one lb. of steam}}=\frac{6{,}000{,}000}{715{,}800}=8{\cdot}382\text{ lbs.}$$

Ratio of expansion required to enable the steam to produce its maximum effect, 10·774.

The detailed computation of this ratio is too tedious to be inserted here. The method pursued is fully explained in the Philosophical Transactions for 1854, Part I.

	Per lb. of water.	Per lb. of coal.
	Cubic feet.	Cubic feet.
Space filled by steam at full pressure,	9·852	82.579
at the end of the expansion, . . = space traversed by the piston.	106·04	888·82

$$\text{Effect of one pound of steam, } \overset{\text{ft.-lb.}}{715{,}800}\times\frac{130}{731}=\overset{\text{ft.-lb.}}{127{,}297}.^{*}$$

$$\text{Effect of one pound of coal, } 127{,}297\times 8{\cdot}382=\overset{\text{ft.-lb.}}{1{,}065{,}008}\text{ as before.}$$

Mean effective pressure during the whole action of the steam,

$$=\frac{\text{effect}}{\text{space}}=\frac{127{,}297}{106{\cdot}04}=\frac{1{,}067{,}000}{888{\cdot}82}=1200{\cdot}46\text{ lbs. per square foot}=8{\cdot}34$$

lbs. per square inch.

Coal per horse-power per hour.

$$\frac{1{,}980{,}000}{1{,}067{,}000}=1{\cdot}86\text{ lbs., as in the 1st Example of the table in Article 10.}$$

B. *Example of the computation of the power produced by the combustion of one pound of coal in a theoretically perfect Air Engine, working between the temperatures of* 270° *and* 140° *of Fahrenheit.*

(The object of the following computation is not to exemplify the mode of working of any existing or proposed air engine, but simply to illustrate the fact, that the maximum theoretical efficiency of thermo-dynamic engines is the same when the limits of temperature are the same, of what nature soever the working substance may be.

It is also to be observed, that the *maximum theoretical duty* of one pound of coal in an air engine is independent of the rate of expansion of the air, and of its density and pressure. The rate of expansion affects the weight of air which must be employed to perform a given duty, and the densities and pressures affect the size of the receivers and cylinders required to contain that weight of air.

If definite values, therefore, are assumed for those quantities in the following calculations, it is only for the sake of fixing the ideas, and giving numbers instead of algebraical symbols.)

Data.—Mechanical equivalent of the whole available heat obtained by the combustion of one pound of coal (as before) 6,000,000 foot-pounds.

Ratio of expansion of air, . . . 1 : 1½

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* This quantity consists of the total action of the entering and expanding steam, on one side of the piston, diminished by the action of the steam which is being condensed on the other side, and also by the power consumed in producing, by the forcible compression of part of the steam into the liquid state, a quantity of heat sufficient to raise the temperature of the water from 140° to 270° Fahrenheit.

The air is alternately expanded and compressed in this ratio.

	During Expansion.	During Compression.
Temperatures (ordinary scale), .	270° Fahr.	140°
Absolute temperatures, .	731 "	601

Product of the volume of one pound of air in cubic feet by its pressure in pounds on the square foot at 32° Fahr., 26,214 ft.-lbs.

Computation of the maximum theoretical duty of one pound of coal by the General Law.

Theoretical maximum efficiency, $\frac{270^\circ - 140^\circ}{731} = \frac{130}{731} = 0{\cdot}178.$

Duty of one pound of coal, $\frac{130}{731} \times 6{,}000{,}000$ ft.-lbs. $= 1{,}067{,}008$ ft.-lbs., as in Example I. of the table in Article 10.

Computation of the maximum theoretical duty of one pound of coal, introducing the changes of pressure and volume of the Air.

Product of the pressure and volume of one pound of air at the temperature of 270°, $26{,}214 \times \frac{270+461}{32+461} = 26{,}214 \times \frac{731}{493} = 38{,}869$ ft.-lbs.

Power developed by one pound of air during its expansion at 270° Fahr. to one and a half times its original volume, being also the mechanical equivalent of the heat expended to produce that expansion.

$38{,}869 \times (\text{hyp. log. } 1\tfrac{1}{2} = 0{\cdot}4054652) = 15{,}760$ ft.-lbs.

Weight of air which is expanded to one and a half times its volume at 270° Fahr. by the combustion of one pound of coal,

$$\frac{6{,}000{,}000}{15{,}760} = 380{\cdot}705 \text{ lbs.}$$

Pressures and volumes of the air at different periods, supposing the greatest pressure to be 120 lbs. per square inch.

	Pressures.		Volumes.	
	lbs. per sq. inch.	lbs. per. sq. foot.	cubic feet per lb. air.	cubic feet per lb. coal.
At the beginning of the expansion,	120	17,280	2·2494	856·358
At the end of the expansion, .	80	11,520	3·3741	1284·537
Space through which the air expands, = space traversed by the piston.	.	.	1·1247	428·179

	Mean Pressures.		Power = Mean Pressure × Space.	
			in foot-pounds.	
	lbs. per sq. inch.	lbs. per. sq. feet.	per lb. air.	per lb. coal.
Mean pressure and power during the expansion,	97.3	14012·83	15,760	6,000,000
Deduct mean pressure and power during the compression, $= \frac{601}{731}$ of the above, . .	80·0	11520·85	12,957	4,933,000
Effective mean pressure and power, $\frac{130}{731}$.	17·3	2492·03	2,803	1,067,000

The calculations A and B illustrate the fact, that the maximum theoretical effect of one pound of coal between a given pair of temperatures is the same, whether the working substance be air or steam.

C. *Example of the computation of the power produced by the combustion of one pound of coal in a theoretically perfect Air Engine, working between the temperatures of* 650° *and* 150° *of Fahrenheit.*

Data.—Mechanical equivalent of the whole available heat obtained by the combustion of one pound of coal (as before), 6,000,000 foot-pounds.

Ratio of expansion of air, $1 : 1\frac{1}{2}$.

	During Expansion.	During Compression.
Temperatures (ordinary scale), . .	650° Fahr.	150°
Absolute temperatures, ...	1111 "	611

Product of the volume of one pound of air in cubic feet by its pressure in pounds per square foot at 32° Fahr., 26,214 foot-pounds.

Computation of the maximum theoretical duty of one pound of coal by the General Law.

$$\text{Maximum theoretical efficiency, } \frac{650-150}{1111} = \frac{500}{1111} = 0{\cdot}45.$$

$$\text{Duty of one pound of coal, } \frac{500}{1111} \times 6{,}000{,}000 = 2{,}700{,}000 \text{ ft.-lbs.},$$

as in Example IV. of the table in Article 10.

Computation of the maximum theoretical duty of one pound of coal, introducing the changes of pressure and volume of the air.

Product of the pressure and volume of one pound of air at the temperature of 650°.

$$26{,}214 \times \frac{650+461}{32+461} = 26{,}214 \times \frac{1111}{493} = 59{,}074 \text{ ft.-lbs.}$$

Power developed by one pound of air during its expansion at 650° Fahr., to $1\frac{1}{2}$ times its original volume, being also the mechanical equivalent of the heat expended to produce the expansion.

$$59{,}074 \times (\text{hyp. log. } 1\tfrac{1}{2} = 0{\cdot}4054652) = 23{,}953 \text{ ft.-lbs.}$$

Weight of air which is expanded to $1\frac{1}{2}$ times its volume at 650° Fahr. by the combustion of one pound of coal.

$$\frac{6{,}000{,}000}{23{,}953} = 250{\cdot}5 \text{ lbs.}$$

Pressures and volumes of the air at different periods, supposing the greatest pressure to be 120 lbs. per square inch.

	Pressures.		Volumes.	
	lbs. per sq. inch.	lbs. per. sq. foot.	cubic feet per lb. air.	cubic feet per lb. coal.
At the beginning of the expansion,	120	17,280	3·4186	856·358
At the end of the expansion, .	80	11,520	5·1279	1284·537
Space through which the air expands, = space traversed by the piston.			1·7093	428·179

	Mean Pressures.		Power = Mean Pressure × Space.	
	lb. per sq. inch.	lb. per sq. foot.	in foot-pounds per lb. air.	per lb. coal.
Mean pressure and power during the expansion,	97·3	14012·88	23,953	6,000,000
Deduct mean pressure and power during the compression = $\frac{611}{1111}$ of the above, . .	53.5	7707·09	13,173	3,300,000
Effective mean pressure and power, $\frac{500}{1111}$.	43·8	6305·79	10,780	2,700,000

Theoretical minimum consumption of coal per horse-power per hour.

$$\frac{1,980,000}{2,700,000}=0\cdot73 \text{ lbs.}$$

as in Example IV. of the table in Article 10.

Synoptical Table of the preceding Examples.

Reference.	Working substance.	Temperatures.		Effective mean pressure, lbs. per square ft.	Spaces	Effects
		Ordinary Fahr.	Absolute Fahr.		Per lb. of coal.	
		°	°		Cubic ft.	Foot lbs.
A	STEAM (maximum pressure 41·93 lbs. per square inch = 6038 per square foot).	270 & 140	731 & 601	1200·46	888·82	1067000
B	AIR (maximum pressure 120 lbs. per inch = 17,280 per square foot.)	270 & 140	731 & 601	2492·03	428·179	1067000
C	AIR (maximum pressure same as above).	650 & 150	1111 & 611	6305·79	428·179	2700000

A detailed mathematical investigation of the theory of air engines, with and without regenerators, is contained in the third and fourth sections of a paper on Thermo-Dynamics in the Philosophical Transactions for 1854, Part I., together with some numerical illustrations.

Theoretical investigations of the duty of air engines of different forms are contained in a paper by Mr. Joule (Phil. Trans., 1851,) and in a series of papers in the *American Journal of Science* for 1853 and 1854, by Professor F. A. P. Barnard, the first American author, so far as I know, who has aided in the development of the consequences of the dynamical theory of heat.

(To be Continued.)

*On "Driers" and the Improvement of House-Painters' Work.**

We are sure it is not necessary to give further reasons for presenting the details which it has cost us some trouble to extract from the elaborate tabular statements of M. Chevreul. We will not attempt to point out the application of the result of each series of experiments; but they deserve every consideration from all who, like ourselves, are interested in the progress of constructive science and the advancement of art. If they do not specify in words, what must be done for the objects *we* have contemplated, they are the necessary basis without which such progress could not be hoped for; and the remaining chapters present particulars equally important to architects and decorative painters, as also to those engaged in the preparation of materials.

We have already, we trust, established safe ground as to the nature of that which is called the drying of the work—under several modifications of the vehicle or pigment used, and the character of the material and surface. We found that the ordinary carbonate of lead base and the pure linseed oil each possessed siccative properties, and that in the case of the oil, these might be increased by time and exposure to the air, supposing it were convenient to resort to such means.

We have received testimony from practical painters to the soundness of the opinion upon which we ventured, as to the constant antagonistic influence of "driers," as regards the chief objects of painting. There is no doubt that much of the want of durability is to be traced to ignorance of such points as we are inquiring into,—or to exclusive regard for early completion of work. It has, however, been apparent, that, considering the time which can generally be allotted, some proportion of "drier" is not to be dispensed with. In particular, we found, that were it the object to escape from deleterious influences entailed by the use of white of lead, by resorting to the white of zinc,—that material had the siccative property in so comparatively slight a degree, as would positively prevent trial of any of its recognised advantages. It, therefore, becomes of some importance to know what is the best mode of preparing "driers."

We shall follow M. Chevreul in his researches, leaving open the question between white of lead and white of zinc; though were we now to accept the latter base of pigments, experiments as to the *ordinary* "drier" might be thought superfluous. We therefore proceed to inquire into the influence of litharge, of peroxide of manganese, and of the mere application of heat, in rendering linseed oil siccative. It is necessary to consider the latter influence, apart from that of the metallic oxide, to ascertain whether the heat is ordinarily applied in the best manner.

The common "drier," or litharged oil, in France, is generally made thus:—Linseed oil is heated to near the boiling point in a melting pot, and skimmed: after three or six hours, about one-tenth of its weight of litharge is added to the oil, and the mixture is again heated for five or six hours. Another method is the following:—100 kilogrammes of linseed oil, as old as possible, are heated for about six hours; six kilogrammes of litharge, and three kilogrammes of burnt umber are then added;

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* From the Lond. Builder, No. 650.

the mixture is heated for six hours, is allowed to settle, and is decanted. The litharged oil, M. Chevreul says, is adulterated with substances which are greatly injurious to its properties. This remark may apply to the sulphate of zinc spoken of by Dr. Thompson, as required to be added to the litharge. The ordinary English method would seem to correspond with that used in France. M. Leclaire, to whom the chief credit of the introduction of oxide of zinc is due, prepares his manganesed oil thus:—Linseed oil is heated at the boiling point for five hours; then for eight hours at least, with peroxide of manganese.—It will now be discovered which are the best methods of procedure.

Experiments were made in the first four months of the year 1850, with the several oils, laid as before, on oak; and we have again tried to condense M. Chevreul's extended statements in a new table. The different kinds of oil experimented upon, are written at the heads of the columns; and the letters of reference (which correspond with those used by M. Chevreul) refer to the notes and particulars below:—

Reference to Notes:—	A	EE	E	B	CC	C	D	F	FF
Oil, how prepared:—	Linseed Oil, pure.	Linseed Oil; boiled 3 hours.	Linseed Oil; boiled 3 hours with 1-10 of its weight of Litharge.	Linseed Oil; boiled 5 hours over a gentle fire in a melting-pot.	Linseed Oil B; again boiled 3 hours (without addition.)	Linseed Oil B; boiled 3 hours with 1-10th of its weight of Litharge.	Linseed oil B; boiled 3 hours with Peroxide of Manganese which had been used previously.	Linseed Oil B; boiled 8 hours with Peroxide of Manganese which had been used previously.	Linseed Oil B; boiled 8 hours (without addition.)
Days occupied in Drying:—									
First coat, ...	99	41	2	54	40	4	5	16	54
Second coat, ...	6	4	3	6	4	5	6	10	
Third coat, ...	3	4	2	8	6	6	6	13	
Total,—Days, . . .	108	49	7	68	50	15	17	39	

Notes and Conclusions from the foregoing Table.

References.

A. EE.—The oil by 3 hours boiling, becomes more siccative.

E. EE.—The oil by 3 hours boiling with 1-10th its weight of litharge, becomes more siccative than if boiled without the litharge.

B. EE.—Five hours' boiling not so advantageous as 3 hours.

CC. C. E.—Oil which has already boiled 5 hours without addition, again boiled 3 hours, undergoes scarcely any change in the siccative property, whilst it becomes more siccative if it has boiled the same time upon litharge: but it is less siccative than the oil which has boiled 3 hours with that oxide without the previous boiling.

D. F.—Oil already boiled 5 hours, boiled 3 hours upon peroxide of manganese that had served previously for a similar operation, is nearly as siccative as the oil which has boiled in the litharge under the like circumstances (C,)—but it is more siccative than if the boiling on the peroxide of manganese had lasted 8 hours.

FF.—Oil which has boiled 5 hours, boiled alone 8 hours more, becomes viscid, and exacts a considerable time for drying.

Generally, these experiments established the fact that the presence of the oxide of lead, or oxide of manganese, will concur with heat in augmenting the siccative property of the oil. But it also appeared from them, that the direct ebullition of the oil with the litharge during three hours only, gave more of the siccative property than the oil would have acquired by the ordinary process,—that is to say, by a previous boiling of three to six hours, or *before* treatment with the litharge. Further experiments were therefore gone into, with regard to that matter. It then appeared:—

1. That linseed oil, which has been boiled in a glass globe in a sand-bath merely, five hours, is not more siccative than the ordinary oil.

2. That the oil which has been boiled three hours, with 15 per cent. of its weight of litharge, or of peroxide of manganese, is more siccative than the oil which has been heated five hours.—At the same time we arrive at these important facts:—

(*a*) That litharge is more siccative than peroxide of manganese.

(*b*) That litharge that has been once heated with the oil, if used for a further portion of oil, is positively more active than that which had not been previously heated.

(*c*) That peroxide of manganese which has been heated many times, has similar effects, relatively to manganese, which had not been heated.

It also appears that—

3. The oil which has undergone a heating of five hours, heated again with 15 per cent. of its weight of litharge, is more siccative than if it had been heated with peroxide of manganese.

But it is remarkable that the *excess* of activity distinguishing the litharge, and the peroxide of manganese which have been used previouly in heated linseed oil, from the same ingredients in their first condition, and where linseed oil was in its original condition, exists no longer where *oil* has undergone the heating process during five hours.

Having discovered that the usual length of time occupied in heating—or rather stewing—in the preparation of "driers," was not advantageous, M. Chevreul proceeded with experiments by which was discovered the fact, that the oil exposed for six hours to a temperature of, as nearly as possible, 70 degrees, with 10 per cent. of peroxide of manganese, could be employed immediately in painting, without the necessity of adding a (or we think it should rather have been stated, *any other*) siccative. Pure oil exposed the same time to the like temperature, receives also a considerable increase of the siccative property, but not to the extent discovered in the other case. The special value of the particular combination referred to is shown by results supposed to be as under. Experiments were commenced at the end of January, 1850, the coats being laid on glass. Pure linseed oil is first contrasted with the manganesed oil: thus—

	Linseed oil.
First coat required to dry, .	21 days.
Second " " " .	10 "
Third " " " .	7 "
Total, .	38 days.

The other result being here stated:—

	Linseed oil, heated six hours, at from 70 to 80 degrees, with 10 per cent. of peroxide of manganese, which had been used previously several times.
First coat required to dry, . . .	3 days.
Second " " " . .	3 "
Third " " " . . .	3 "
Total, . .	9 days.

An addition of white of zinc to the oil last mentioned, appears to give an increase of siccative property, much exceeding what it would give to the pure oil.

This branch of the subject may be wound up with the results of a comparison of oils differently treated, as under. The experiments were commenced at Midsummer, 1850, the coats being laid on glass. The oils were (using letters of reference for the columns of the table):

(A.) Pure linseed oil.
(B.) The same oil, exposed six hours to a temperature of 70 to 80 degrees.
(C.) The same oil, heated during six hours at a temperature near to the boiling point, with new peroxide of manganese.
(D.) The same oil, heated in the same manner with peroxide, which had been used twice.

Days occupied in drying.	A.	B.	C.	D.
First coat, . .	6	4	2	0½
Second " . .	6	5	4	4
Third " . .	5	5	4	2
Total: Days,	17	14	10	6½

The short period occupied in the drying of the first coat in the fourth column is remarkable. In some previous experiments, similar unexpected results occur where coats were laid on wood. Those cases suggested to us inquiry whether sufficient absorption could have taken place to ensure durability. It is, however, due to M. Chevreul to say that this question was not wholly neglected, for independent of the record given of the exact state of the surface on every day during the progress of the experiments (our own pages having limited us to results,) in experiments tried on certain materials, the paint is specially mentioned as of slight adherence to the wood. These instances are chiefly in the concluding chapter.

Various additions have been made to the pure substances, carbonate of lead and oxide of zinc, not only in the course of extensive adulteration which is practised, but in other cases, with the idea of particular beneficial results. It may therefore be interesting to follow our author where he endeavors to find what is the sort of influence which certain bodies, mixed with one or other of the above mentioned bases, will exercise as regards the general drying properties. He finds that sulphate of lead mixed with linseed oil is much less siccative than the carbonate,—the three coats—if laid on oak in summer—occupying nearly three times as long in the drying as three coats, similarly laid, of the carbonate. However, whilst the bulk of the excess of time was occupied by the first coat, the second coat of the sulphate dried in precisely the same number of days as that of the carbonate. A *mixture* of the sulphate and the carbonate appears to have been introduced in France about 1850. That material, M. Chevreul found would dry as well as the pure carbonate; in other words, the sulphate had received from the carbonate a considerable accession in siccative properties. But it is observed that the mixed material had some tendency to work unevenly under the brush.

Passing to the zinc base,—the *sub-carbonate* of zinc has been tried. It begins to dry more quickly than the oxide, and might therefore be supposed to afford advantages, if mixed with the latter. It has, however, the disadvantage of being "semi-transparent," and is altogether very different to the white of lead, or even to the white of zinc. Still, M. Chevreul thought advantage might be taken of the peculiar siccative property, as a substitute for the oil of manganese, which has the inconvenience of interfering with that peculiarity of the oxide of zinc, for which, at all events, it is valuable, namely, its peculiar whiteness. Experiments were commenced, therefore, on two deal doors, and in Midsummer, 1849, with the mixtures designated below, A and B:—

		Parts by weight.
(A.)	Pure linseed oil, . .	100
	White of zinc (oxide) 0¾ by measure, Sub-carbonate of zinc, 0¼ by measure,	100
(B.)	Pure linseed oil, . . .	98
	Manganesed oil, . .	2
	White of zinc (oxide,) . .	100

The first coat applied of each, had an equality of aptitude as regards the covering of the surface; and four hours after application the paint had taken hold. The mixture A, however, showed a disposition to dry best where most exposed to the light. On comparison at the end of a year, the door painted with A was sensibly more white than the other. Perhaps, however, the paint was less adherent than the mixture B. Yet M. Chevreul does not seem to consider the difference of much moment, since he goes at once to the advantages of the admixture,—saying, that whilst there can be no material difference as to the drying in A and B, the former has advantages with white grounds, or such light tints as yellow would be injurious to.

The effect of finely-divided powders upon the drying of a vehicle, is, M. Chevreul remarks, that of accelerating the drying,—as might be expected, apart from chemical influences.

In the course of our examination into the series of experiments, we have attached, certainly, great importance to the absorption of the coating by the material painted. No artist, we are sure, will differ with us for having gone greatly beyond M. Chevreul, in desiring with the durability of substance and surface, the absence as a general rule, of all shining appearance. No doubt the brilliant and the "dead" character of surface can be used side by side, and might be so more frequently than they are, with the best effect. Nevertheless, there is good esthetic reason for the practice of finishing the best kind of work in flatted color. Wherever there is "surface enrichment," in form or color, or where there is moulded ornament, a general shining varnish seems to be only antagonistic to the effort of the design. Such a surface by reflecting, is necessarily unequal and accidental in its effect, and calculated to annihilate defined form. Herein, lies a disadvantage of pictures painted in oil, as compared with those in fresco,—a disadvantage which was well understood a few years since, when the subject was under discussion, but which latterly seems not to have received much consideration.

We allude again to this element in our subject of investigation, because the experiments which are the last mentioned in M. Chevreul's paper, appear to be not unconnected with the end to which the discoveries of chemistry will, we hope, one day reach. On this point we hope to offer some suggestions.

For the Journal of the Franklin Institute.

Storm's Cloud Engine.—Correction of Error.

To the Committee on Publications.

Gentlemen—My attention has been called to an article upon "Storm's Cloud Engine" in the August number of your Journal, in which a statement is made, that in justice to myself and others should be corrected.

I refer to that portion of the editorial remarks which states that "the experiments, alluded to in the concluding paragraph, were conducted, we believe, under the superintendence of Charles W. Copeland." This is an error.

No experiments producing such results as those stated were conducted by me. Experiments had been made by others, in which some such amount of gain (about 60 or 80 per cent.) was reported.—It *is* true that I have been conducting a series of experiments, but the results have not yet been reported on to the Company, (except verbally;) in fact, the whole series has not yet been completed. Preparations are now being made for that purpose.

Charles W. Copeland.

For the Journal of the Franklin Institute.

Consumption of Fuel by the Steamer Ericsson in a Voyage from Havre to New York.

We publish the following memoranda of the consumption of fuel by the steamer *Ericsson*, in a late voyage from Havre to New York. The weather for the greater part of the trip was very unfavorable, the wind being ahead and the sea very rough, and the wheel of the steamer was so defective as to give but little increase of speed when the number of revolutions was increased from 10 to 15 per minute; yet we consider the economy of fuel so remarkable as to deserve a permanent record. They are copied from the daily official reports of the Engineer.

The *Ericsson* is 260 feet long and 40 in maximum breadth; draft loaded, 18 feet. Tonnage, 2003. The engine consists of 2 inclined cylinders, 62 inches diameter, 7 feet 10 inches stroke. The boilers are of an oval form, 17×14×10 feet. The condensers are on a plan patented by Captain Ericsson, and furnish hot fresh water to the boilers. The wheels are 32 feet in diameter, 10 feet on the face and dip when the vessel is loaded 5 feet.

The following table is an extract from her log:

Date.	Revolutions.	Coal used in tons.	Pressure.	Vacuum.	Cut-off.	Distance run in nautical miles.	Temperature of fire room.	
1855.		T. Cwt.			Feet.			
Aug. 5,	5,532		33·	27·	3·		76	Broke valve of air-pump.
" 6,	12,768		33·	26·5	3·	207	90	Winds ahead and heavy —sea very rough.
" 7,	15,196	12 16	34·5	26·	3·	195	88	
" 8,	11,947	11 10	31·	25·5	3·	87	83	
" 9,	13,571	18	32·	26·	3·	185	90	
" 10,	15,226	18 13	34·	26·5	2·9	153	. .	
" 11,	14,302	19 02	31·	26·	2·9	153	84	
" 12,	17,598	20	32·	26·	2·9	204	84	
" 13,	14,277	18 08	30·	26·	2·9	161	80	
" 14,	15,111	19	33·	26·5	2·9	170	78	
" 15,	15,495	18 08	35·	26·	2·6	144	90	
" 16,	16,885	18 13	31·	26·5	2·6	185	86	
" 17,	21,253	20	35·	26·5	2·9	237	90	
" 18,	19,968	20	33·	26·5	2·6	205	96	
" 19,	20,753	21 13	35·	26·5	2·6	222	94	Wind light—sea calm.
" 20,	21,211	20 07	34·	28·	2·3	233	96	
" 21,	21,691	21 10	35·	25·5	2·3	245	96	

The average consumption is 18·533 tons per day.
" " speed 186·6 nautical miles per day.

The fuel burned was partly Welsh and Pennsylvania Anthracite, and, for a short time, Cumberland coal.

In the last three days, with Pennsylvania Anthracite as fuel, the average consumption was 20·76 tons per day; the distance run, 233 nautical miles per day, or 9·5 per hour. J. F. F.

For the Journal of the Franklin Institute.

English Novelties.

New Form of Safety Valve.—We notice in the *London Practical Mechanics' Journal*, a description of a new form of safety valve, lately brought out by W. Hawthorne, Newcastle-on-Tyne. It is designed to apply to the objection against the conical valve ordinarily used, that when lifted by hand, or by a pressure of steam but slightly above that to which it is loaded, only a small passage is afforded the steam between the valve and seat; so that in order to insure the requisite area for the exit of all the steam generated in a boiler, it is necessary to employ a valve whose area is far greater.

Mr. Hawthorne proposed the use of what are called annular safety valves, and drawings are given of two or three plans in which the principle is carried out, of affording large area, the moment the valve is raised from its seat.

In the first of these, the seat is flat and perforated with narrow openings; the valve is likewise flat and is also similarly perforated, the concentric openings falling between those in the seat, and at such distances, that when the valve is seated, the requisite lap is given, to insure tightness. Radial ribs hold the parts of the valve together and to a central sunken boss, on the bottom of which bears the point of the stud connected at its upper end with the lever and weight, or with the spring pressing it down, as the case may be.

It is obvious that the moment the valve lifts, free opening is afforded.

In the second plan an annular opening is left in the seat turned conically on each edge, into which is fitted a ring (bevelled), which ring is connected by radial ribs to the central bearing boss. By raising a valve so made, opening is afforded both inside and outside the ring, and of course the width of the annular opening by its mean circumference will give the required area, and the narrower the ring, the greater in proportion will be the circumferential opening.

The third plan proposed is the Cornish double beat or equilibrium valve.

The idea thus proposed may not be entirely novel, but it appears to us to be a good one and worth trial. There are few parts of steam machinery to which engineers more tenaciously hold than the old-fashioned safety valve, while we know of none more defective, or in which it is so vitally important to introduce every possible improvement.

Pump Stuffing Boxes.—Mr. H. Teague, in an article contained in the *Journal*, previously quoted, recommends the introduction of a species of hollow lantern brass in the middle of the depth of pump stuffing boxes; opposite to this brass, in the stuffing box, a pipe is inserted, leading to the discharge pipe, so that the pump will always draw water through any leakage opening in the stuffing.

Fluid Measures.—To obviate the difficulty and expense of graduating separately by measurement each fluid glass now made, Mr. H. Hudson, of South Shields, England, has patented a process for making them by pressure, so that they will be always of precisely the same size and may be graduated by the same scale. To accomplish this end, the mould is made either solid or in parts as may be required by the configuration of the vessel; and a plunger of the shape required for the interior is brought down into it, melted glass having previously been dropped in. By this method the inequalities incident to the hand process must be completely avoided.

Driving Belts.[*] J. Blaikie, Glasgow. Patent dated November 7, 1854.

Smoothness of action, so essential in most kinds of machinery, very much depends on the quality of the driving belts employed, and great difficulty is experienced in obtaining leather of uniform thickness for making such belts, so that any efficient means of producing belts possessing the necessary qualifications, at a comparatively cheap rate, must be considered as a great boon by the machinery-using community of manufacturers. The present invention professes to confer this boon, and merits some attention on that ground, independently of its claims as bringing very simple means to the accomplishment of the desired result. The invention relates to the preparation and manufacture of belts, straps, and bands, such as are used for driving machinery and for other purposes, in such manner as to produce perfect uniformity, as well in the main body of the leather or material employed as at the junctions, where the overlapping of the ends is effected. The leather or other material to be used in the manufacture of the belt, or band, is first passed through a machine for the purpose of equalizing its thickness, by shaving or slicing off the superfluous material wherever such superfluity may exist. This machine consists of a rectangular frame, having at one end a roller or gauge-piece capable of being set up at a greater or less distance from a stationary cutter or knife. The band to be treated is entered by one end between the cutter or knife and the roller or gauge-piece, and it is then forcibly drawn through between these contiguous surfaces, by a pulley or other suitable action. This treatment causes the cutter or knife to slice off all the superfluous material, and bring the band down to the requisite thickness and uniformity. After this process, the band or piece of leather is passed through a somewhat similar machine, or through the same machine suitably arranged, for the purpose of beveling the junction ends of the leather. To accomplish this action, the thicknessing roller or gauge-piece, which is set parallel with the knife, is carried upon the ends of the shorter arms of two curved or inclined levers set on fixed studs in the machine framing. The band is then drawn through as before between the cutter and its gauge-piece or roller, this tractive action being conveniently effected, by a rack and pinion movement driving the holding clamp for the end of the band. This traversing holder carries adjustable stud-pins, made to bear on the upper sides of the longer arms of the lever, or levers, with which the cutter roller or gauge-piece is connected. Hence, as the traverse goes on, and the leather is drawn through the adjustable studs upon the traverse, details bear down upon the shaping levers, and cause the roller or gauge-piece to gradually approach the cutting edge, and thus cause the cutter to make an inclined or beveled slice. The beveled ends of such bands may be joined together for use, either by cement or stitching, or in any other convenient manner. Bands or belts made in this way are perfectly uniform in thickness, and they are for this reason far more effective in action than bands of the common kind.

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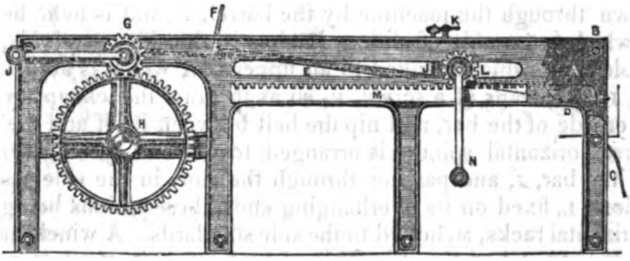
[*] From the Lon. Prac. Mech. Journal, August, 1855.



Our engraving is a side elevation of the improved machine for equalizing the thickness of belts for machinery. The details of the machine are carried in a framing consisting of a pair of parallel cast iron side standards, connected together by tension rods. The knife, A, by means of which the belt is reduced to the required uniform thickness, is situated close to the end, B, of the frame, and it is fixed by having its two ends entered into slots in the side standards, being accurately adjusted by means of external pinching screws. The edge of the knife is towards the end, B, of the machine, and the belt, C, to be operated upon passes under it, and between it and a roller carried in eyes in the ends of two short levers fast on a transversed spindle, D, turning in eyes in the side standards; and this spindle has also formed or fixed upon it a long lever, E, which has a graduated segment, F, formed on its outer end. By raising or lowering the lever, F, the guide roller is made to recede from or approach the cutting edge of the knife, A, and by so doing the thickness to which the belt is to be reduced is accurately determined, the graduated segment, F, serving as an index, by which the position of the roller is regulated. The belt, C, is stretched upon the surface of the roller, so as to be presented to the knife edge in a uniform tight manner, by means of a bar capable of adjustment to suit the thickness of the belt under treatment. After passing under the knife, A, the belt, C, passes on over the driving-spindle at G, and thence to the winding-up barrel at H. The spindle of this barrel has keyed upon it a spur-wheel in gear with a pinion fast on the spindle, G, upon which is also fixed a winch-handle, I. By turning this handle, the barrel, H, is made to wind up the belt, C, and so draws it through between the roller and the knife, A, and by these means the belt is reduced to a uniform thickness, the knife taking off all the material of the belt which exceeds the thickness for which the apparatus is set.

Arrangements are provided in the same machine for beveling or tapering the junction ends of the belt. This beveling is effected by causing the guide-roller to gradually approach the knife, A, as the belt is drawn through the machine. When the end of the belt is to be beveled, it is not drawn through the machine by the barrel, H, but is held between a bar, J, which is capable of sliding in slots in the side standards, and an adjustable clamp-piece, linked to an upper bar, which is adjusted upon the bar, J, by means of a screw, K, so as to draw the clamp up against the under side of the bar, and nip the belt between itself and the bar. A transverse horizontal spindle is arranged to work in eyes formed on the ends of the bar, J, and passing through the slots in the side standards, has pinions, L, fixed on its overhanging ends, these pinions being in gear with horizontal racks, M, bolted to the side standards. A winch-handle, N, is fixed on one end of the spindle, and by turning it, the bar, J, will be made to traverse along the slots, in consequence of the action of the pinions, L, on the racks, M. At the part of the bar, J, which is immediately over the lever, E, is a screw-pin, which, as the bar, J, traverses away from the end, B, of the machine, gradually depresses the lever, E. By these means, as the end of the belt is being drawn between the knife, A, and the guide-roller, the latter is made to gradually approach the knife, which, consequently, cuts more and more deeply into the material, finally getting quite through it, and producing a regularly-formed bevel upon the end of the belt. The length of the bevel or inclined portion of the belt is regulated by adjusting the screw-pin in the bar, J, so as to commence its action on the lever, E, at a point nearer to, or further from, its centre of oscillation. The length of the bevel is also determined by means of a gauge-piece, O, at the end, B, of the machine, being held in an adjustable socket-piece screwed to one of the tension bars of the frame. The gauge, O, is set at a distance from the knife edge, A, corresponding to the length of bevel to be given to the end of the belt, and the belt is introduced in such a manner that its extreme end will just reach the gauge, O, at the commencement of the beveling action.

For the Journal of the Franklin Institute.

Particulars of a New English Iron Steamer, Alma.

Hull built by Thomas B. Seth; Machinery by A. & J. Inglis, Glasgow. Intended service, coastwise.

HULL.—			
Length of keel and fore rake,		115 feet.	
" on deck,		112 "	5 inches.
Depth of hold,		8 "	8 "
Length of engine and boiler space,		21 "	8 "
Draft of water at load line,		7 "	3 "
Tonnage,	hull, 179; engine room, 37.		
Contents of bunkers in tons of coal,	15.		
Mast and rig,	three masted schooner.		
ENGINES.—Non-condensing—Inverted cylinder.—			
Diameter of cylinders,			14 inches.
Length of stroke,		1 foot	8 "
Maximum pressure of steam in pounds,	60		
" revolutions per minute,	120.		
BOILER.—One.—			
Length of boiler,		10 feet	6 inches.
Breadth "		5 "	10 "
Number of furnaces,	1.		
Breadth "		5 feet.	
Length of grate bars,		11 "	
Number of tubes, brass,	103.		
Internal diameter of tubes,			2 inches.
Length of tubes,		8 feet.	
Diameter of smoke pipe,		2 "	
Height " "		16 "	
Description of coal,	Bituminous.		
Draft,	Natural.		
Nominal horse power,	35.		
PROPELLERS.—			
Diameter of screw,		5 feet	10 inches.
Length of blades,		3 "	
Pitch of screw,		10 "	
Number of blades,	8.		

Remarks.—Frame, *shape and dimensions*, |—3×2½×$\frac{5}{16}$ inch; distance apart *at centres*, 18 inches; stem, keel, and stern posts, 3½ × 1¼ inches. Clincker built. Stows 150 tons of freight, and has accommodations for six passengers.—Has run 450 miles in 41 hours 30 minutes, consuming 6·5 tons of coal.

H.

For the Journal of the Franklin Institute.

Particulars of the Steamboat Island Home.

Hull built by E. S. Whitlock; Machinery by Morgan Iron Works, New York. Intended service, Boston to Cape Cod.

HULL.—			
Length on deck from fore part of stem to after part of stern post above spar deck,		193 feet.	
Breadth of beam at midship section,		29 "	
Depth of hold,		9 "	3 inches.
Draft of water at load line,		4 "	6 "
" " below pressure and revolutions,		4 "	6 "
Tonnage, custom house,	450.		
Masts and rig, none.			
ENGINE.—Vertical beam.—			
Diameter of cylinder,			40 inches.
Length of stroke,		11 feet.	
Maximum pressure of steam in pounds,	40.		
Cut-off,	½.		
Maximum revolutions per minute,	23.		
BOILER.—One—Flued.			
Length of boiler,		27 feet.	
Breadth " furnace,		11 "	6 inches.
Height " exclusive of steam drum,		10 "	6 "
" " inclusive "		20 "	6 "
Number of furnaces,	2.		
Breadth "		5 feet	1 inch.
Length of grate bars,		7 "	
Number of flues, lower tier, 10, upper tier, 5.			
Internal diameter of upper flues,			16 inches.
Length of upper flues,		19 feet	8½ "
Heating surface, (fire and flues,)	1358 sq. feet.		
Diameter of smoke pipe,		3 "	8 "
Height " "		30 "	
Description of coal,	Bituminous.		
Draft,	Blast.		
WATER WHEELS.—			
Diameter,		28 feet.	
Length of blades,		7 "	
Depth "			24 inches.
Number "	24.		

Remarks.—Floor timbers at throats, *molded* 14 inches; *sided* 5 inches. Frames apart, at centres 24 inches. Frame strapped with diagonal double laid straps 3 by ½ inch. C. H. H.

Improvements in the treatment of certain Bituminous mineral substances, and in obtaining products therefrom.[*] By JAMES YOUNG, of Manchester. Patent dated October 17, 1850.

This invention consists in treating bituminous coal in such manner as to obtain therefrom an oil containing parafine (which the patentee calls parafine oil), and from which oil parafine is obtained. The coals best fitted for this purpose are such as are usually called parrot coal, cannel

[*] From the Mechanics' Magazine, April, 1851.

coal, and gas coal, and which are much used in the manufacture of gas for the purpose of illumination, because they yield, upon distillation at a high temperature, olefiant and other highly illuminating gases in considerable quantity; and although some of the coals last described contain a large amount of earthy matters, those matters do not interfere materially with the performance of this process. To obtain parafine oil from coals, the following is the method of procedure:—The coals are to be broken into small pieces, and are then to be put into a common gas retort, to which is attached a worm pipe passing through a refrigerator, and kept at a temperature of about 55° Fahr. by a stream of cold water. The temperature of the refrigerator should not be made too low, lest the product of the distillation should congeal and stop up the pipe. The retort being closed in the usual manner, is then to be gradually heated up to a low red heat, at which it is to be kept until volatile products cease to come off. Care must be taken to keep the temperature of the retort from rising above that of a low red heat, so as to prevent as much as possible the desired products of the process being converted into permanent gas. The coke or residue may then be withdrawn from the retort, which, being allowed to cool down below a visible red heat (to prevent waste of the fresh material to be introduced), may be again charged with a quantity of coals to be treated in the like manner. The crude parafine oil distilled or driven off from the coals as a vapor, will be condensed into a liquid in passing through the cold worm-pipe, from which it will fall into a vessel which must be provided to receive it. Instead of obtaining the whole of the parafine oil by distillation, a portion of it may in some cases, if thought desirable, be run from the retort (through an opening and a pipe provided in the anterior and lower part of the retort for that purpose) after it has separated from the coal and assumed a liquid form. The patentee prefers, however, in every case to distil or drive off the whole of the parafine oil to be obtained from the coal. The production of the desired products from a charge of coals in a retort will be known to be finished by the liquid ceasing to run from the worm. The crude product of this process is an oil containing parafine, which the patentee calls parafine oil. This oil will sometimes, upon cooling to a temperature of about 40° Fahr., deposit parafine. Other arrangements of apparatus may be used for subjecting coals to the process for obtaining parafine oil therefrom, but that abovementioned is preferred as being well known and easily managed. But in order to obtain the largest quantity of crude parafine oil from coals by means of this process, and produce the smallest quantity of permanent gas by the action of the heat employed, whatever may be the apparatus used, care must be taken to heat the coals gradually, and to apply the lowest temperature necessary to complete the operation. During the distillation or driving off, a permanent gas will be produced, and this gas may either be collected or suffered to escape, as may be thought expedient. The crude oil obtained, as already described, is purified in the following manner:—I put the oil into a cistern, and heat it (by a steam pipe or other means) to a temperature of about 150° Fahr. When thus treated, water and undissolved impurities contained in the oil will separate more readily from it than when cold, and the oil being left in a state of rest and kept warm for about a day, many of those impurities will fall to the bottom of the cistern, and the oil may then be run off into another vessel, leaving the residuum behind. For distilling the oil the inventor prefers to use an iron still with a worm-pipe connected to it, passing through a refrigeratory apparatus, which is kept at or about the temperature of 55° Fahr., as already mentioned. The still is heated by a fire underneath it, which is kept up until the whole of the oil has been distilled over, and it will then be found that the still contains some dry carbonaceous residuum, which should be taken out before the still is again used. The oil is to be run from the condensing apparatus as it distils over into a leaden vessel, where, to each 100 gallons there are gradually added 10 gallons of the oil of vitriol of commerce. After this mixture has been well stirred for about an hour, it is to remain at rest for about twelve hours, so that the oil of vitriol and the impurities with which it has combined may settle at the bottom. The supernatant oil is then drawn off into an iron vessel, and to four gallons of a solution of caustic soda, of a specific gravity 1·300 (water being 1·000), added to each 100 gallons. The soda and oil are stirred together for about an hour, so as to neutralize any acid which may remain in the oil, and also take up any impurities capable of combining with it, after which the contents of the vessel are allowed to remain at rest for about six or eight hours, so that the solution of soda may subside, and then the supernatant oil is to be drawn off, and again distilled in the same manner as already described. Parafine oil obtained from the last mentioned distillation contains a fluid more volatile than parafine, a considerable portion of which may be separated from the oil and obtained in a separate state as follows:—The oil is placed in an iron still connected with a worm-pipe passing through a refrigeratory apparatus, and half its bulk of water being added, the contents of the still are boiled for about twelve hours, adding water from time to time, so as to keep about the same proportions of oil and water in the still.

The volatile fluid will pass over along with steam, and be condensed in the worm-pipe by the refrigeratory apparatus. This fluid will be clear and transparent, and as it is lighter than water, it separates, on standing, from the water with which it will be mixed as it leaves the worm-pipe of the still. This fluid may be burnt for the purpose of illumination, or applied to any other useful purpose to which it may be applicable. The last-named process will separate the greater portion of the volatile fluid from the oil, but a larger quantity may be separated by prolonging the operation. The oil left in the still after the completion of the process is then to be carefully separated from all the remaining water (upon which it will float) and conveyed into a leaden vessel, where two gallons of oil of vitriol are to be added to each 100 gallons. This mixture is to be well stirred for six or eight hours, after which it is allowed to stand undisturbed for twenty-four hours, in order that the vitriol may settle to the bottom of the leaden vessel, carrying with it all impurities with which it has combined. The supernatant oil is now to be drawn off into another vessel, and to each 100 gallons there is added 28 lbs. of chalk, ground up with a little water into a thin paste. The oil and chalk are to be well agitated until the oil becomes entirely freed from any trace of sulphurous acid, which may easily be known by heating a little of it in a glass retort, and testing its vapors by moistened blue litmus paper. If the vapors change the color of the litmus paper to red, the oil must be treated with more chalk. This oil is to be kept warm—say at 100° Fahr.—in any convenient vessel for about a week, to allow impurities to settle, and it is then fit to be used for lubricating purposes, either by itself or mixed with an animal or vegetable oil, or it may be burnt by itself in Argand lamps for the purpose of illumination. To extract parafine from the purified parafine oil obtained in the manner described, the oil is to be cooled to a low temperature—say to 30° or 40° Fahr.; and the lower the temperature, the larger will be the quantity of parafine separated from the oil. In this way parafine is made to crystallize, when it may be separated from the oil by filtration through woollen or other cloths, and then squeezing it in a powerful press, by which means it will be made sufficiently pure to be employed for lubricating and some other useful purposes. But the parafine may be further purified, if required, by treating it several times, at a temperature of about 160° Fahr., alternately with its own bulk of oil of vitriol and with a similar quantity of a solution of caustic soda (of the specific gravity already mentioned) until the parafine ceases to render the oil of vitriol black. It is then to be washed in a weak solution of soda, and lastly with boiling water, until the water ceases to change the color of red litmus paper. Another method adopted to obtain parafine from parafine oil is, to put the oil into a still, and distil over one-half or more of its contents. The portion then remaining will contain a much larger proportion of parafine than the parafine oil at first put into the still contained; this residue being then distilled over into a separate vessel, and allowed to cool. Parafine may be separated by filtration and squeezing in cloths, and also purified by treatment with oil of vitriol and soda, as before described. Parafine oil from which parafine has been separated, as above described, still contains parafine in solution, and is suitable for lubricating or lighting purposes.

Method of Making Charcoal for Gunpowder.[*]

A committee appointed by the French Government, to examine and report upon a new method of making charcoal for gunpowder, has recently fallen under our notice, and as it may be interesting in these times, we shall lay a translation of it before our readers. There has been a powder manufactory of great celebrity at Esquerdes, in France, for several years. It was formerly conducted by M. Violette,[†] who adopted a mode of making charcoal by the emyloyment of water heated to a high temperature. The only objection to this process was its great cost, M. Gossart, his successor, conceived that he had discovered a method of obtaining the same result at a great reduction of expense, and it is this method which is reported on by the committee.

The apparatus, say the committee, proposed to be constructed at the powder mill of Esquerdes, is capable of converting about 220 lbs. weight of wood into charcoal at one time.

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[*] From the Lond. Pract. Mech. Journal, August, 1855.

[†] See articles on M. Violette's steam preparation of wood, vol. i. p. 106. and vol. ii. p. 95.

The water intended to be converted into steam is injected into the body of a pump, the piston of which is loaded with a weight slightly superior to the expansive force of the vapor.

The pressure of the piston forces the water upwards through a series of tubes placed inside one of larger diameter.

These tubes are intended to cool the gases and to condense the vapor after their exit from the carbonizing apparatus, the circulation taking place from above, downwards. The cold water contained in the tubes is gradually heated during its ascent, by means of the gas and vapor which pass through the outer tube. It is thereby brought almost to the temperature of ebullition, and is in part converted into vapor in a twisted tube arranged in such a manner as to cover the roof and walls of the furnace.

The water being vaporized in these tubes, is heated to a still higher temperature by being made to pass across bars of metal.

The vapor thus heated is conducted into a reservoir of cast iron provided with a thermometer and manometer to indicate its heat and expansive force. It is then passed into the carbonizing apparatus, from which the vapors and gases are conducted along the large tube already mentioned, where the vapor is condensed, and the gas, having been perfectly cooled, is thrown out at the bottom of the apparatus.

The air intended for the support of combustion is heated by passing round a portion of the wall of the chimney, and thus arriving in a heated state under the grate, heat is economized.

The advantages claimed for this system are the following:—

1. Only one furnace is required, in place of two, for the production of the vapor, and the raising it to a high temperature.
2. No more water is subjected to heat than is sufficient to produce the required quantity of vapor.
3. Much of the heat formerly lost is now utilized.
4. The employment of metal furnaces allows a greater heating surface to be obtained, at a low cost.
5. The production of heat is regular, and the temperature is regular also.
6. The products are capable of being compared one with another.

The arrangement for supplying hot air beneath the grate is a very beneficial one.

Finally, the proposed apparatus is reported to be ingeniously constructed, combining the advantages of economy and regularity in the manufacture of charcoal.

Steam Boiler Explosions.[*]

We have this month to direct attention to an unwonted increase in the number of explosions of steam boilers during the last few weeks. We give an illustration, representing the exact appearance of one of the boilers after the explosion which took place at Messrs. Adnit's Oil Mill, at

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[*] From the London Artizan, August, 1855.

Chiswick, on Monday, the 16th of July; and we have taken some pains to obtain correct details of this case, otherwise than by collating the generally incorrect reports of the newspaper press.

There has been one explosion of a locomotive at Camden Town, a week previously to the above, recorded in the "*Times*" of July 14th. Another locomotive burst on the 2d July, on the South Yorkshire Railway, at the moment of its being detached from the train, by which the fireman is stated to have been blown high up into the air and killed. The explosion of the boiler of a steam tug at Shields, called the *Witch*, is also mentioned in the daily papers of the 13th July. Besides the above, the Manchester papers give us reports of other explosions in that vicinity; one, at a wood-turner's, in Blackfriars Street, Salford, by which the stroker, *fifteen years of age*, was killed, and the boiler, 11 feet × 3 feet diameter, $\frac{3}{8}$-inch thick, was projected through several thick walls to a distance of 90 feet from its bed. The same paper, the "*Manchester Times*," of June the 16th, gives us an account of an explosion occurring two days previously, of remarkable importance, from the eminence of the engineers' names connected with it. It was one of the celebrated Nasmyth's *upright* boilers, 25 feet long by 5 feet diameter, on the premises of the no less eminent engineers, Messrs. Beyers, Peacock, & Co., of Gorton, near Manchester. This boiler contained an inside chimney flue, *three feet in diameter*, made of $\frac{3}{8}$-inch plates, which *collapsed;* although it is stated that it was *calculated* to bear 100 lbs. per square inch pressure, and was working at 65 lbs. shortly before the explosion took place. If this statement is correct, it is perhaps fortunate for the gentlemen who made the "*calculation*" that no one was killed.

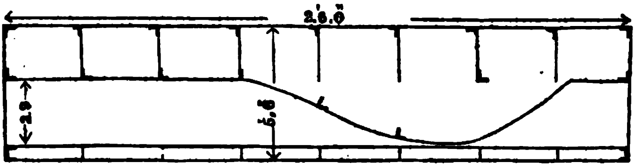
The marine boiler referred to above was working at the now prevaling system of very high pressure, toward which we appear to be infallibly drifting, the certain consequence of bad trade and low prices for engineering work.

We have here, in as many weeks, examples of these deplorable accidents, as they are called, in each of the great departments of steam engineering—stationary, locomotive, and marine—calling loudly for a more adequate investigation, than the subject has perhaps yet received. They have certainly been, happily, not attended with many casualties, or loss of life to so great an extent as frequently happens, and therefore cannot excite that great and painful interest in the public mind which we sometimes witness. This circumstance is, however, a reason rather in favor of than against a scientific discussion of the subject at the present time, inasmuch as the exact state of matters just previous to and at the moment of explosion can generally be ascertained to a greater nicety before than after fatal consequences have ensued. The parade of coroners' inquests, and the possible verdicts for manslaughter, are to a certain degree preventives of that fearlessness in witnesses imperatively necessary to elucidate any scientific truth, involved in such conflicting hypotheses as this subject confessedly is.

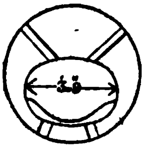
In the Chiswick explosion above referred to, we have, happily, a *living* engine driver to testify to the fact of the explosion occurring at the very moment of his opening the stop-valve for starting the engine, instead of a *dead* man to be blamed by some eminent engineer for overloading the safety-valve.

Very many instances of explosions taking place at the time of starting the engine will occur to the readers of *The Artizan*, when one would naturally expect such a release to the confined steam would tend to diminish, rather than to increase, the pressure in the boiler.

Without adverting to the popular truism on all explosions—"the weakness of the boiler and the strength of the steam," and without speculating further on this Chiswick case at present, we may safely state that a slight inspection of our sketch will satisfy our engineering readers that the *oval shape* of the inside flue tube, and the small quantity of water over it, have had a good deal to do with the explosion.



The boiler was made by Messrs. Wilson & Co., of Leeds, about three years ago. It is 5 feet 6 inches in diameter and 26 feet long, and originally had the furnace fixed underneath, but not giving sufficient steam it was altered within the last nine months, by having an oval furnace tube, 3 ft. 9 in. × 2 ft. 9 in., with the furnace placed inside; the tube being stayed, as shown, through its whole length, by stays 4" × ½", which are now torn away from the rivets, and the top of the tube is collapsed and beat down within an inch of the bottom. The plates, for about 10 feet in length, over the furnace, are of Low-Moor iron. The safety valve was loaded to the average pressure worked with (20 lbs. on the inch) at the time the explosion took place, which was at about twenty minutes to one P. M., the workmen having just returned from dinner, and the engine-driver being in the act of opening the stop-valve to start the engine. It is considered fortunate by the proprietors that no loss of human life took place, although two horses were scalded to death.



Description of a Self-Capping Rifle.[*]

At a recent meeting at the Institution of Civil Engineers, M. Néron, of Paris, exhibited an ingenious mode of placing detonating caps on the nipple of a rifle or a musket. The apparatus consisted of a tube containing twenty-two caps, placed parallel with and close beside the barrel, being partially inserted in the stock, and so arranged, that whilst the near end was attached by a pin to the hammer, the further extremity was free to travel in a slot. Its action was very simple; the tube being filled with caps from a reservoir, several of which would occupy but a very small space, the end cover was turned down. On drawing the hammer to half-cock, the tube was drawn forward until a cap was brought over the nipple, and at full-cock the cap was pressed down upon it. After firing, if any portion of the copper remained attached to the cap, it was removed by a small picker preceding the tube on its being again drawn forward to repeat the operation. It was evident, that by this simple and cheap addition to any fire-arm much time must be saved in loading, and a great waste of caps must be avoided, whilst about twenty five per cent. of copper was saved in making the caps, and they were kept dry in the reservoir instead of being exposed to damp and running the risk of not exploding, as had occurred frequently in action on recent occasions in the Crimea. The system was stated to have obtained the approbation of the highest military authorities in France, and with the characteristic alacrity of the government of that country, to be already in process of adaptation to the Minié rifles and to fire-arms of all kinds for the army; it had only within the last few days been brought here to lay before the English government, and was submitted for the inspection of the Members of the Institution of Civil Engineers.

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[*] From the Lond. Civ. Eng. and Arch. Journal, February, 1855.

*Dimensions of the New Iron Steamer Royal Shepherd.**

Melbourne and Launceston new iron screw-propeller steam-vessel "*Royal Shepherd.*" Built and fitted with machinery by Messrs. Blackwood and Gordon, iron ship-builders and engineers, Paisley, 1853.

Dimensions—Customs' Measurement.		
Length on deck,		148 feet 1 tenth.
Breadth at two-fifths of midship depth,		19 " 8 "
Depth of hold amidships,		10 " 5 "
Length of poop,		36 " 6 "
Breadth "		16 " 7 "
Depth "		6 " 5 "
Length of engine room,		31 " 9 "
Tonnage.		
Hull,		221 23-100 tons.
Poop,		44 07-100 "
	Total,	265 30-100
Engine room,	71 07-100	80 82-100 "
Shaft tunnel,	9 75-100	
Register,		184 48-100 "
Builders' Measurement.		
Length of keel and fore-rake,		140 feet.
Breadth of beam,		20 "
Length of engine room,		31 " 11 inches.
Tonnage.		
Hull,		272 32-94 tons.
Engine room,		67 82-94 "
Register,		204 44-94 "

A pair of oscillating engines of 50-horse nominal power; diameter of cylinder, 30 inches; length of stroke, 2 feet 6 inches. Screw propeller: diameter, 7 feet 2 inches; pitch, 10 feet 6 inches; has two blades. One tubular boiler: length, 10 feet 4 inches; breadth, 9 feet 2 inches; depth, 10 feet 6 inches. Three furnaces. 200 tubes: diameter, 3¼ inches;

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* From the Lond. Artizan, July, 1855.

length, 6 feet 6 inches. Launched, November, 1853: draft of water, forward, 4 feet; ditto aft, 5 feet 7 inches: average speed, 10 knots an hour; consumes 7 cwt. of coals per hour; engines averaging 45 revolutions per minute. Has passenger accommodation in full poop. Sailed out to Melbourne, from the Clyde, under canvass, and is now plying in consort with the *Black Swan*, also built by the same firm, between Launceston and Melbourne, with goods, passengers, &c.; carries about 276 tons of cargo.

Description.—Three masts; barque-rigged.

*Dimensions of the Iron Steamer Anglesea.**

Liverpool, Bangor, Beaumaris, and Menaibridge new iron paddle-wheel steam-vessel "*Anglesea.*" Built and fitted with machinery by Messrs. Blackwood and Jordan, iron ship-builders and engineers, Paisley, 1855.

Builders' Measurement.

Length of keel and fore-rake,	160 feet 6 inches.
Breadth of beam,	19 "
Length of engine room,	46 " 7 "

Tonnage.

Hull,	289 29-94 tons.
Engine room,	90 21-94 "
Register,	199 08-94 "

Customs' Measurement.

Length on deck,	160 feet 6 tenths
Breadth at two-fifths of midship depth,	18 " 6 "
Depth of hold amidships,	10 " 3 "
Length of engine room,	46 " 6 "

Tonnage.

Hull,	245 29-100 tons.
Engine room,	96 61-100 "
Register,	148 68-100 "

One steeple engine (one piston rod,) of 60-horse nominal power: diameter of cylinder, 42 inches; length of stroke, 4 feet. Paddle wheels: diameter over floats, 16 feet 6 inches. 17 floats: length, 7 feet 6 inches; breadth, 1 foot 4 inches. Two tubular boilers: length at crown, 10 feet $9\frac{1}{2}$ inches; ditto at furnaces, 9 feet 11 inches; breadth, 10 feet 9 inches; depth, 9 feet. 560 cubic feet of steam and 794 cubic feet of water, when tubes are covered 9 inches. Six furnaces: length of fire-bars, 6 feet 2 inches; breadth, 2 feet 9 inches. Three furnaces in each boiler. 420 tubes, or 210 in each boiler: diameter, $3\frac{1}{8}$ inches; length, 6 feet 6 inches; having two funnels (bell tops;) diameter, 2 feet 10 inches; length, 21 feet. One boiler before and the other abaft the engine. Contents of coal-bunkers, 35 tons; frames, $3 \times 2\frac{1}{2} \times \frac{3}{8}$ and $\frac{5}{16}$ of an inch, spaced 18 inches apart; eight strakes of plates from keel to gunwale, tapering in thickness from $\frac{7}{16}$ to $\frac{5}{16}$ of an inch; three bulkheads. Averages 30 revolutions per minute. Was launched from the building yard at Cartvale, March 20th. Draft of water with machinery, &c.: forward, 5 feet 8 inches; aft, 6 feet 6 inches. The cabins are very tastefully fitted up, and ornamented with stained glass paintings, representing Welsh scenery, &c. The skylight is also ornamented with stained glass, and has a handsome and beautiful appearance. The figure-head is a Welsh female, in the national costume of the country. This vessel is capable of accommodating from 350 to 400 day passengers. The masts are rakish, with wire rigging, giving the vessel a smart looking appearance.

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* From the London Artizan, July, 1855.

Description.—A demi-female figure-head; no galleries; three masts; schooner-rigged; standing bowsprit; one main and quarter deck; square sterned and clincher built vessel: clipper bow. Owners, Messrs. Price and Case.

Port of Liverpool. Commander, Mr. John Hunter (late of the *Menai*).

*Dimensions of the Steamer Corio.**

New iron screw propeller steam-vessel "*Corio.*" Built by Messrs. Scott and Co., iron ship-builders, Cartsdyke, Greenock; machinery by Messrs. Blackwood and Gordon, engineers, Paisley, 1854.

Dimensions.		
Length on deck,		99 feet 7 tenths.
Breadth at two-fifths of midship depth,		17 " 1 "
Depth of hold amidships,		9 " 3 "
Length of quarter deck,		25 " 4 "
Breadth " "		15 " 0 "
Depth " "		3 " 7 "
Length of engine space,		22 " 8 "
" shaft tunnel,		10 " 4 "
Breadth " "		3 " 3 "
Depth " "		3 " 6 "
Tonnage.		
Hull,		112 70-100 tons.
Quarter deck,		11 13-100 "
Total,		123 83-100 "
Engine space,	39 24-100	40 55-100 "
Shaft tunnel,	1 31-100	
Register,		83 28-100 "

A pair of inverted cylinder engines of 20-horse nominal power: diameter of cylinders, 20 inches; length of stroke, 1 foot 8 inches. Screw propeller: diameter, 6 feet 10 inches; pitch at centre, 12 feet 10½ inches; ditto at circumference, 14 feet 6 inches; has two blades. One tubular boiler: length at crown, 10 feet 2 inches; ditto at furnaces, 9 feet 7 inches; breadth, 6 feet 1 inch; depth, 8 feet 11 inches. No steam chest. Two furnaces: length, 6 feet 2 inches; breadth, 2 feet 2 inches. 86 tubes: diameter, 3 inches; length, 6 feet 6 inches. Chimney (bell top): diameter, 2 feet 7 inches; length, 20 feet 6 inches. Geelong, November 20th, arrived from the Clyde; was totally dismasted, and received other damage, in a gale which lasted from the 19th to the 29th of October, (during which time, the late commander, as also the steward, was washed overboard and lost.) Employed in the coasting trade of Australia; carries about 111 tons of cargo.

Description.—No figure-head or galleries; standing bowsprit; 2 masts; brig rigged; round sterned, and clinch built vessel; common bow.

Port of Greenock.

*Her Majesty's New Yacht "Victoria and Albert."**

On looking over the "Navy List," the other day, we were very much struck with the fact that of all the vast naval armament now in course of construction, only *one* paddle-wheel vessel appears in that list, all the others being screws.

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* From the Lond. Artisan, July, 1855.

As it—the Royal yacht—may be the last of the *paddle* race in the Royal Navy, we have much pleasure in being able to give our readers the following particulars of this vessel.

The makers of the machinery are the Messrs. John Penn and Son, and from the high standing of this firm as marine engineers, we fully expect that this last example of the *paddle*, constructed for great speed, with all the necessary qualities of compactness and strength combined with lightness,—we say we fully expect that the machinery of this vessel will embody all the experience in marine engineering during the last thirty years, and prove highly creditable to the constructors.

There are four boilers, two placed before and two abaft the engines, with a funnel to each pair of boilers, and the stoke-hold amidships. The following are a few of the principal dimensions of the boilers :

Length of boiler, (athwartship,)	10 feet.	
Width of fire room, "	10 "	
Length of boilers (fore and aft) each,	21 "	9 inches.
Height "	14 "	6 "
Number of furnaces in each boiler,	6.	
Width "	3 "	2 "
Length "	6 "	6 "
Length of tubes, (brass ferruled,)	6 "	5 "
Diameter of ditto,		2½ "
Internal diameter of ferrules,		2 "
Number of tubes in the four boilers,	3024.	
Total fire-grate surface,	504 sq. ft.=84 per H. P.	
Total heating surface in flues and tubes,	14,059 sq. ft.=23·4 per H. P.	
Area through tubes,	9,493 sq. in.=15·8 per H. P.	
Pressure on the safety-valve,	20 lbs. on the square inch.	

On carefully looking over the above figures, we cannot but be struck with the very much more common-sense view taken by our engineers now-a-days.

We have often regretted to see, as we have often seen, vessels loaded with *large engines*, and on making the inquiry, "Have you plenty of steam?" "No," was the usual reply, and it is too often so still that the answer is, "*No, we are short of steam.*" And it cannot be denied, that the boiler, as the source of power, is too often lost sight of. This, however, cannot be said of the boilers of the Royal yacht.

The following are a few dimensions of the engines:—

Nominal horse power,	600 horses.
Diameters of cylinders, (vibrating,)	88 inches.
Length of stroke,	7 feet.

The paddle wheels are feathering and overhung, the outer bearing being supported on the ship side: each wheel weighs about 50 tons.

Diameter of wheel,	31 feet.
Number of floats,	14 in each wheel.
Size of floats,	11 ft. 6 ins. long×5 ft. 1½ ins. broad.

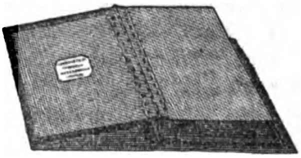
The vessel was designed in the Surveyor of the Navy's Office, and built at Pembroke Yard. As we saw her the other day, in the dock at Portsmouth, she looked a splendid specimen of modern naval architecture; her internal fittings and accommodation are in every way worthy of our beloved Sovereign, and an honor to the nation. It is expected that she will steam at about 16 knots per hour.

The following are a few of the principal dimensions of the vessel:—

Length between the perpendiculars, .	300 feet.
Breadth, extreme, . .	40 " 3 ins.
Mean draft of water, . .	15 "
Tonnage, builders' old measurement.	2342 tons.

Hinged Account-Book Covers. *

Messrs. Waterlow and Sons are now introducing a very valuable improvement in the manufacture of account books, charging no more for books on the improved than for those on the ordinary principle. A metal hinge, as shown in our engraving, is employed for fastening the inside of the book, to its cover, in the place of the linen joints ordinarily employed. By this improvement the inside of the book is entirely independent of the covers, and may be separated from them by the mere withdrawal of the sliding hinge-pin, so that one cover may be used for several books, or new covers supplied at pleasure to an old book, without the necessity of the book itself being placed in the hands of the binder. The great objection to the common glued joints is their liability to give way under the influence of a damp atmosphere; but with the improved hinge arrangement this is, of course, impossible. By the use of the metallic hinge, the pages of the book are allowed to lay quite flat, wherever it may be opened, an advantage which every accountant will know well how to appreciate.



For the Journal of the Franklin Institute.

On the Framing of Steam Engines.—Correction of Error.

Mr. Editor—In the July number of the *Journal*, is an article by T. D. Stetson, on the framing of steam engines, in which he ascribes to me the credit of designing the machinery of the steamer "*Knoxville.*"

His statement, in this particular, is incorrect, and does great injustice to Horatio Allen, Esq., who is entitled to the credit of all the peculiarities of said machinery. The inclined columns referred to were previously adopted in the steamer *Augusta*, designed also by Mr. Allen, and proved entirely satisfactory. Respectfully,

New York, September 13th, 1855. D. G. Wells.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, September 20th, 1855.

John Agnew, Vice President, in the Chair.

John F. Frazer, Treasurer.

George M. Conarroe, Recording Secretary, pro tem.

The minutes of the last meeting were read and approved.

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* From the Lond. Civ. Eng. Jour., April, 1855.

Letters were read from The Society of Arts, London: The Mechanics' Institute of the City of San Francisco; Thomas U. Walter, Esq., Washington, D. C., and the Kentucky Mechanics' Institute, Louisville, Ky.

Donations to the Library were received from The Austrian Engineers' Association, Vienna; The Smithsonian Institute; Thomas U. Walter and T. R. Peale, Washington City, D. C.; Honorable Joseph R. Chandler, U. S. Congress: The Legislature of the State of Pennsylvania, and Thomas D. Hart; Dr. L. Turnbull, Prof. J. A. Kirkpatrick, Prof. M. H. Bayé, and Henry Nolens, Philadelphia, Pa.

Donations to the Cabinets from Joseph Mascher, David W. Jayne, and George M. Conarroe.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer read his statement for August.

The Board of Managers and Standing Committees reported their minutes.

Resignations of membership of the Institute, from 4 gentlemen, were read and accepted.

Candidates for membership in the Institute, (7,) were proposed and the candidates proposed at the last meeting, (2,) were duly elected.

Dr. Rand exhibited a specimen of aluminium.

Dr. Rand also presented a mass of scale from Messrs. Pardee & Morgan, of New Haven, Connecticut, consisting almost entirely of carbonate of lime, which was taken from an iron cylinder twenty-eight feet long and two feet two inches in diameter, situated in a room over the boiler in which water is turned to steam. This cylinder is kept for warming water previous to entering the steam boiler, and rests on wooden supporters ten inches from the floor. The water is warmed by the application of steam on the top of the water which enters the cylinder through an iron pipe five inches in diameter. The scale was taken from the upper side of the cylinder just around the steam pipe. The water is taken from a well four to six feet from the surface of the ground and one hundred and fifty feet from the bank, which is washed by the waters of New Haven Harbor. It is about two years since this cylinder was cleaned, and there was never before a similar formation in it.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Mr. Abraham Masson's Steam Motive Power.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, a "Steam Motive Power," invented by Mr. Abraham Masson, of Philadelphia, Pennsylvania—Report:

That this engine differs from that class usually denominated "Rotaries" in one essential particular, viz: that neither the piston nor cylinder revolves around the axis of the latter, nor around any line parallel thereto, so that the fundamental objection to rotary engines, usually so called, arising from leakage and unequal wear of packing, cannot be urged against this form of engine. It consists, in general terms, of four cylinders whose axial lines are at right angles with each other and tangents at four points to a circle whose centre corresponds with that of the main shaft; the revolution of the four cylinders about this point, (producing revolution of the shaft to which they are attached,) is obtained by guiding the ends of the piston rods to a fixed involute curve or a curve eccentric with the main shaft. Three modifications of this engine have been designed. In the first plan, the curve is a circle, fixed eccentric with the shaft to which the cylinders are attached. In the second, two (or four) concave involutes are connected continuously and fixed so that their extreme points may be circumscribed by a circle concentric with the main shaft. Thirdly, a single involute forming one-fourth of a complete one is fixed, and the piston rods of each opposite pair of cylinders are connected together, so that the end of at least one of each pair shall be on the curve at any time.

1st. *Originality.*—The Committee understand from Mr. W. C. Grimes, of this city, that a device similar to the first of the three engines above named, was modelled by him some years since, and abandoned as not promising results of practical value. Of this they can speak only on his authority, not having access to the model. The other two forms of engine are, so far as they are aware, original with Mr. Masson.

2d. *Advantages.*—The principal advantage which can be claimed for this form of engine is, equality or uniformity of pressure during the entire revolution. This is, undoubtedly, an important one, but the Committee believe that the employment of two oscillating cylinders disposed on opposite sides of the same shaft, would produce an uniformity so nearly the same as Mr. Masson's engine, as to be considered such in practice, while in such arrangement the space taken up would be, in a line perpendicular to the shaft (and horizontally) not much greater; in the line of the shaft the same; and in vertical height materially less.

3d. *Disadvantages.*—The Committee consider the employment of four cylinders a complexity which would materially increase the expense and wear of the engine, and which would not be compensated for by the slight additional uniformity in motion. On the other hand, it is true, that the valve gearing is remarkably simple, consisting, as proposed by Mr. Masson, of a single ring on each side pierced with openings for the inlet and outlet of steam, pressing against bored cavities in the block containing the four cylinders, which, by their revolution, bring at the proper times, their own steam and exhaust openings opposite those in the ring.

Of the three forms of engine the Committee consider the first described to be the best, as by its use, the jar and wear incident to the other two would be avoided.

The Committee have endeavored to give Mr. Masson's plan all the consideration to which it is entitled, and, although their judgment of its practical value is rather unfavorable, they cannot close their report without remarking on the ingenuity displayed by Mr. Masson, not only in the original idea of such a plan of engine, but in developing it in its details.

By order of the Committee,
Wm. Hamilton, *Actuary.*

Supplementary Report.

Subsequent to the foregoing report, Mr. Masson has brought to the notice of the Committee another modification of the same principle, in which the chief objections previously made, appear to have been overcome. In this plan only two cylinders are used, their central or axial lines being parallel and equidistant from the centre of the shaft to which they are affixed; the piston rod ends are confined in a slot cut in a continuous double involute curve fixed in proper position, so that steam presses on one piston till after it has been admitted on the other, and there is always a pressure tending to revolve the shaft. The continuous curve presents no points at which the jarring alluded to in the former report can take place.

The Committee believe that this form of engine possesses such advantages as to simplicity and cheapness as would warrant its trial on a large scale. By order of the Committee,

Wm. Hamilton, *Actuary.*

Philadelphia, September 13th, 1855.

Description and Drawings. By H. Howson, Civ. Eng.

A is the base plate of the engine, to which are secured the standards, B, having pedestals on the top serving as bearings for the main shaft, C.

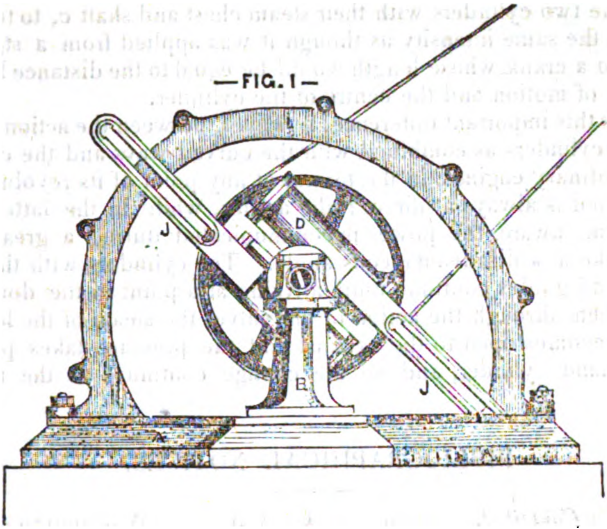
D D are two cylinders of exactly the same bore and placed parallel with each other: cast to these cylinders and serving to connect them together, is the circular hub or steam chest, F, and inside this chest is an annular projection, also cast to the two cylinders; the inside of the chest and outside of the projection being turned perfectly true with each other, and the projection being bored out for the reception of the shaft C, to which it is permanently secured. The top of the circular chest and the annular projection are faced so as to receive a suitable stationary cover, inside which is the stationary valve, G, of the peculiar form shown in fig. 3; the hub of the valve surrounding the projection, and its two edges bearing against the inside of the chest.

Each projecting portion of the valve is furnished with a wedge, I, so that on being forced by screws (too minute to show in the drawing) into a cavity formed for the purpose, the valve is caused to expand and fit tighter to the inside of the steam chest, when both shall have become worn and leaky through continual friction.

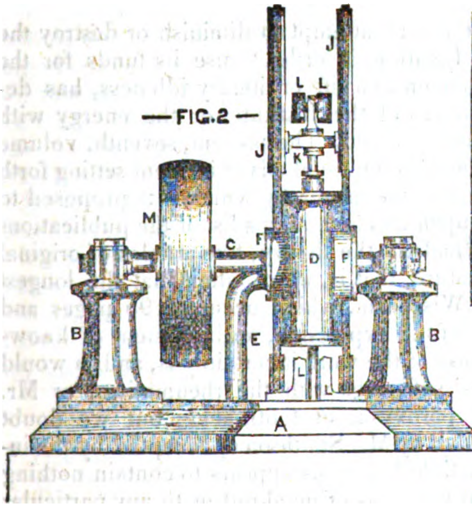
E is the steam pipe secured to the cap of the steam chest and communicating with the inside of the same on one side of the valve, and on the opposite side of the valve is the exhaust pipe. H H are two passages communicating with the interior of the steam chest and the ends of the cylinders D, the passage of one cylinder leading to the space on one side of the valve G, and the passage of the other cylinder to the space on the opposite side.

The cylinders are furnished with pistons having rods which project through stuffing boxes or covers, in the usual manner, the piston of one cylinder projecting in a contrary direction to that of the other. To the piston rods are secured the cross-heads K, which slide in the guides J, two of the latter being attached to each cylinder. Above the cross-head the end of each piston is furnished with two rollers, one on each side, which are confined in the flanches of the curved ways L, the latter being connected to each other at intervals and to the base plate by suitable bolts.

—FIG. 1—



—FIG.2—



—FIG. 3—

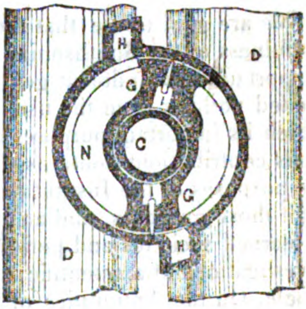


Fig. 1 is a front elevation of the engine.
Fig. 2 an end view of the same, and
Fig. 3 a sectional view of the valve apparatus.

It should be observed here, that the shape of the curved ways, is that of a double involute, which is preferred as the best curve adapted for the purpose.

The valve, G, is so arranged, in regard to the passages H, that the steam acts on the bottom of the piston of one cylinder only at a time.

As the engine is shown in the engraving so as to revolve from right to left, the steam is acting on the piston of the left hand cylinder, forcing the rod with its rollers against the flanches of the curved ways, L, and causing the two cylinders with their steam chest and shaft C, to turn with a force of the same intensity as though it was applied from a stationary cylinder to a crank whose length would be equal to the distance between the centre of motion and the centre of the cylinder.

There is this important difference, however, between the action of these revolving cylinders as combined with the curved ways and the crank as used in ordinary engines; in the former at any point of its revolution the force exerted is always at direct right angles, while in the latter, as all engineers are aware, the power is communicated during a greater part of the stroke at a disadvantageous angle. The cylinders with their piston rods and guides continue until arriving at a point in the double involute, when, through the action of the valve, the steam of the left hand cylinder becomes open to the exhaust and the pressure takes place on the right hand cylinder, and so the change continues as the machine revolves.

BIBLIOGRAPHICAL NOTICES.

Smithsonian Contributions to Knowledge, Vol. VII. Washington; Smithsonian Institute, 1855, 4to.

We are glad to see that the recent attempt to diminish or destroy the usefulness of the Smithsonian Institute, in order to use its funds for the support of a few indolent gentlemen in a life of literary idleness, has detracted nothing from the usefulness of the Institute, or the energy with which its important purposes are pursued. The present, seventh, volume of its contributions contains, besides the usual advertisement setting forth the purposes of the Institution and the means by which it is proposed to fulfil those purposes, and an appendix containing a list of the publications of learned societies and periodicals in the library, five articles of original investigations of a scientific nature; that is, if we admit that the longest article, On the Antiquities of Wisconsin, which occupies 95 pages and 53 plates, is, in any fair sense of the expression, an increment of knowledge among men. In one sense of the word it certainly is, and so would be the record of Mr. Tomkins' sufferings with the rheumatism, or Mr. Grundy's sensations under a paroxysm of tooth-ache; but we doubt whether this is the sense intended by Mr. Smithson or accepted by the interpreters of his will. The article before us appears to contain nothing in any way more interesting to the mass of mankind or to any particular class of it, and if Professor Henry will accept for publication all the lucubrations of equal value, which are sent for publication to our various societies, there will certainly be no quarreling about surplus funds. The opinion of those who take the most interest in this subject of American antiquities, appears to be nearly unanimous that the article possesses no novelty or intrinsic value sufficient to re-pay the cost of publication or the labor of reading it, and we should come to the same conclusion from a mere inspection of the wood cuts of articles which are common in the most juvenile collections of Indian antiquities. With the exception, then, of this article, each of the contributions to the present volume present matters of considerable interest to us. The first is "An Account of a Tornado near New Harmony, Indiana, with a Map of the Track, &c. By John Chappelsmith. In this short paper, Mr. C. has given a brief account of a tornado and presented a general map of its course, together with a detailed plan of the most interesting part of its region, and drawings of the phenomena, the whole intended to supply facts, so much wanted for the determination of the truth of the various hypotheses proposed to account for these meteors. The conclusions of Mr. C. are unfavorable to the idea of a whirl of any kind, but lead him to the belief in a centripetal blow towards an uprising central column. His essay bears the marks of care and patient research, and, although we cannot agree entirely with his conclusions, we are not the less thankful to him for a very considerable and reliable increase of our knowledge on this interesting and much vexed question. It is, we think, worth remarking, that if any credit be given to the agreeing testimony of several witnesses as to the appearance of flame in the cloud, it must go very far to support Dr. Hare's, otherwise very probable suggestion of an electrical cause for the phenomenon. Following this paper is one by Professor Bailey of West Point, describing and figuring in very elaborate and neatly executed plates, a number of microscopic forms from various localities between California and Nova Scotia. The article is, for the most part, merely technical, but contains some remarks in relation to such forms as applied as tests for the excellence of microscopes which will be interesting to a large class of our community who are beginning to take great interest in this instrument. Dr. Leidy's Memoir on the Extinct Sloth Tribe of North America, is also a technical paper on palæontology, which will, we are sure, be very acceptable both here and abroad to the students of this branch of science.

Besides the merit of the papers, the plates in these volumes give evidence of the very important assistance giving by the Smithsonian Institute to the art of engraving, by affording encouragement to a style and finish which has been heretofore too rare in our country. The plates in the present volume, from the precision and minuteness required, present great difficulties both in execution and printing, and are, we think, equal to any executed abroad.

A Treatise on Pneumatics, being the Physics of Gases Including Vapors. By Martin H. Boye, M. D., A. M.; Philadelphia, E. C. & J. Biddle, 1855: 12mo. pp. 116, & 12 pp. Tables.

This is a very valuable contribution to our works of popular science, by the Professor of Natural Philosophy and Chemistry in our High School, whose name is already familiar to all whose attention has been turned to chemistry, as an analytical chemist of uncommon merit. We insist in denominating the work one of popular science, although the author in his Preface, seems rather to shrink from the appellation. But by such a term, we wish to indicate a work in which the principles of science are so explained as to be easily comprehended, and consequently, interesting to the great body of readers, who are not familiar with mathematical processes, or with technical language. Such works are Herschel's and Arago's treatises on Astronomy; Brewster's on Optics, and many others which might be named. Such works when they are really good, require perhaps a higher order of intellect for their composition than is demanded for the strict technical development of natural laws by means of mathematical analysis, and are of incalculable value by encouraging true scientific inquiry on the part of large masses of the community, who have been too long disgusted and frightened from such pursuits by the extrinsic and unnecessary difficulties with which they have been surrounded. The present work is a very excellent manual on a very important and little understood branch of physics—that of gases—and will be especially useful for the treatise which it contains on the Barometer. A severe critic might perhaps pick out a few unimportant inaccuracies and blemishes from its pages, but, upon the whole, it is well digested and arranged; gives the results of the best and most modern authorities, and may be consulted with advantage not only by those who desire to learn Pneumatics for the first time, but those, who, familiar with its principles, seek to refresh their memory of its data.

It is well illustrated with wood cuts, well printed, and supplied with numerous valuable tables.

A Manual of Photographic Chemistry. By T. FREDERICK HARDWICK. American Edition; New York, S.D. Humphrey, 1855, 12mo. pp. 284 and cuts.

This book has been very highly approved of by those who are engaged practically in Photography, and certainly does contain a great mass of interesting facts, and descriptions of valuable processes, so arranged as to be easily referred to by those desirous of studying them.

The Photographic art has been extended and improved with extraordinary rapidity, and in no country has it been practised with greater success than among ourselves. We have very high authority for asserting, that the best Daguerreotypes in the French Industrial Exhibition, are from America, as was also the case in the London Exhibition: and the authority of our own eyes for the belief, that except in size, there are not in Paris, (the French Photographs are, we believe, admitted to be the best in Europe,) any photographs better than those made here. It is desirable, therefore, that our operators should be made familiar with all that is done abroad, and encouraged in their endeavors to add their part to the stock of original discovery and improvement in their art. The new processes have given such rapidity, beauty and precision to the pictures, that little appears to be yet wanting, except the fixing the natural colors, which Becquerel has obtained; and even this an American pretends to have done. What has become of the Hillotype?

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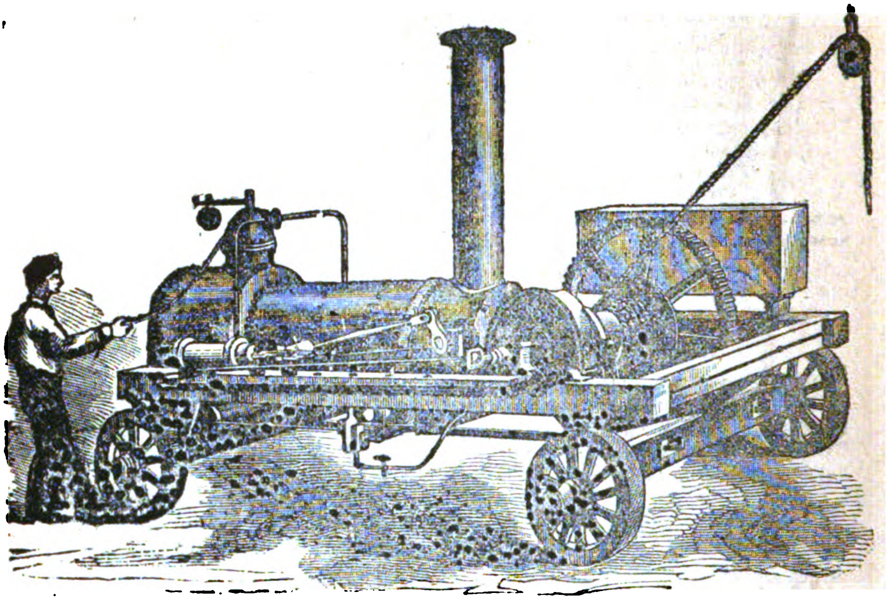

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The Engine, which was exhibited at the Franklin Institute in 1851, was purchased by the Philadelphia Gas Company, and used for several months in raising water with elevators and hoisting. This engine having been superseded by another of increased power, in 1852, was afterwards purchased by the Schuylkill Navigation Company. Major Jones has had one in operation on his farm in Cecil County, Maryland, for some months, as a substitute for the horse-power formerly used by him in driving his threshing machine. Another was constructed by order of Pierce Butler, Esq., to be employed on the lands of the North American Coal Company. In 1853, a double cylinder Hoisting Engine was built for the Schuylkill Navigation Co. One for J. J. Holland, of Williston, S. C., with two 8-inch cylinders, for driving a Portable Saw Mill. One for the Philadelphia and Reading Railroad Co., with two 8-inch cylinders, for pumping. One for the Lebanon Furnaces, with two 6-inch cylinders, for hoisting coal and iron. One for the Dauphin and Susquehanna Railroad Co., with two 6-inch cylinders, for hoisting stone, &c., for bridge building. One for the Dauphin and Susquehanna Coal Co., for hoisting and pumping; and one for J. Sterrell & Co., Mifflin, Pa., for driving Barrel machinery.

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References.—Prof. J. C. Cresson, Supt. Phila. Gas Works; Thos. I. Potts, Iron Merchant; Pierce Butler, Esq.; Rob. Kelton, 113 N. Water st.; H. Haupt, Chf. Eng. Penn'a. R. R. Co.; L. G. Mytinger; A. S. & W. L. Roberts, 80½ Walnut St.; Wm. Mahone, Chf. Eng., Norfolk & P. R. R. Co.; S. B. Sutton, St. George's, Del.; C. P. Morton, Mortonville, Chester County, Pa.; Sam'l. Entriken, Paoli, Pa.; Richard Heckshcr, Minersville, Pa.; J. Dutton Steel, Esq., Civil Eng. Phila. & Reading R. R. Co.; R. B. Osborn, Chf. Eng. Dauphin & Susq. R. R. Co.; F. Fraley, Pres. Sch. Nav'n Co.; S. A. & W. Henderson, Norristown; Spencer & Mason, Pottsville; G. D. Coleman, Lebanon, Penn.; J. J. Holland, Williston, S. C; Maj. John Jones, Md.

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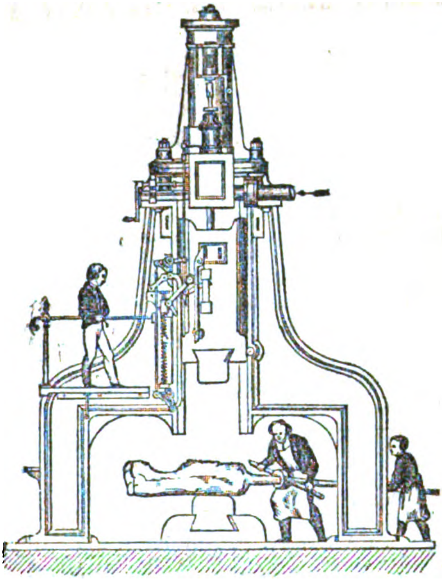

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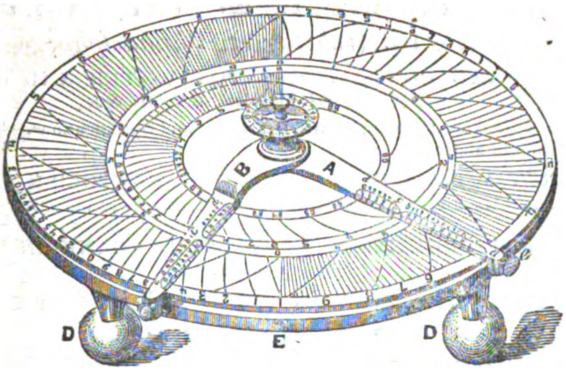

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JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

NOVEMBER, 1855.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Inter-oceanic Ship Canal via the Atrato and Truando Rivers. By EDWARD W. SERRELL, Civ. Eng.

For many years attempts have been made by several of the most enlightened governments of the world, and by enterprising individuals, to determine the practicability of connecting the Atlantic and Pacific Oceans *by water*, artificially.

The minds of those who have investigated the subject most closely, and among them the great Humboldt, seem to have rested on three localities, namely, the Isthmuses of Nicaragua and Panama, and the Atrato river.

The latter, probably owing to the considerable breadth of the country, has, until very recently, received but little attention.

During the past four years, however, many very elaborate surveys have been made on its waters and tributaries, and the surrounding country. These examinations have been conducted by Mr. John C. Trautwine, Mr. James C. Lane, and Captain William Kennish, and the several corps under their directions.

They have been undertaken at the instance of American merchants; the expenses of the last two surveys, and of obtaining the rights to construct the works, have been borne by Mr. Frederick M. Kelley, of New York.

The Atrato is a broad and deep river. For seventy miles from its mouth it has an average depth of forty-seven feet, and the channel-way for this distance is from eight hundred to twelve hundred feet in width.

At the mouths of the river, which finds its way into the Gulf of Uraba or Darien by nine bocas or estuaries, there are bars formed from sedimentary deposits, and the water is only four or five feet deep.

The bay itself is very ample, and deep enough for the largest vessels.

The line for the contemplated connexion between the oceans, ascends the Atrato sixty-three miles; it then enters the valley of a tributary known as the Truando, which is followed for thirty-six miles.

This river is now navigable for vessels drawing twelve feet of water, for thirty-eight miles from its confluence with the Atrato.

From the Atrato, for thirty-six miles, it is intended to deepen and widen the Truando, and then to make an open cut through rock twenty-five miles to the Pacific Ocean.

The cut will average ninety-six feet deep, excepting a tunnel, three and a quarter miles in length.

It is contemplated to make the prism of the canal, two hundred feet wide and thirty feet deep at extreme low tide.

The river Atrato flows at the rate of about two and a half miles per hour, and the point of confluence with the Atrato, as determined by Mr. Kennish, is 15·2 above mean level in the oceans.

On the Pacific there is a rise and fall of the tide at the outlet, of twelve feet three-tenths. At the mouth of the Atrato on the Atlantic, there is but twenty inches rise and fall. So that when the cut is complete, the Atrato will have two mouths, one emptying into the Atlantic, and the other into the Pacific. The passage from ocean to ocean will be up one mouth and down the other.

The currents in these channels will, on the Atlantic side, be varied but little from what it now is, as the head will be reduced but about one foot, as determined by the comparison of the sections of the streams, and the quantity of supply.

The velocity of the water through the new channel, at high water in the Pacific, will be equal to that which is due to a head of 14 feet, minus six feet one and a half tenths; and at low tide 14 feet plus 6·25; so that without reference to the *flow* of the tide *into* and *out of* the cut, which however will equilibrate it, the current in mean will be essentially the same as to the Atlantic, excepting that which is due to greater straightness in the new channel.

All the material necessary for constructions upon the line of the work exist in the country, excepting the metals.

An excellent harbor already exists at the Atlantic terminus, and on the Pacific but little labor is required to make the harbor there equal to any for safety and accessibility on the coast.

The distinctive features of this route are, an inter-oceanic connexion, having depth and width sufficient to pass the largest vessels abreast now afloat, and upon which no locks or any other obstructions of any kind will occur, and that there are good harbors at either end.

The country through which the line passes where the constructions and deepening of the river Truando have to be done, is very healthy and productive.

On the Atrato, the only unhealthy part of the route, there is no work to be done, except at the bars of the mouth, and here the climate is comparatively salubrious from the constant sea breezes.

In making the surveys, very ample notes of the geology, botany, and sylvia, have been taken, and the sanitary condition of the country at the various locations, together with the meteorological changes, have been noted.

Mr. Serrell has estimated the cost of the work, predicated on the data furnished by Mr. Kennish, at one hundred and forty-seven millions of dollars.

Several of the most eminent engineers in the country have been consulted, and corroborate this estimate.

By the data furnished from Mr. Stone's commercial statements of the present trade of the world, it has also been estimated that the present business between the two oceans, that would pass through this Canal, if now in use, without making allowance for any increase, would pay twelve per cent. on a cost of two hundred millions of dollars, and then save to itself six per cent. or upwards of three hundred and eighty millions of dollars.

It has also been estimated that twenty-five thousand men will have to be constantly employed for twelve years to build the work.

This number can be maintained and sustained, as the average haul for supplies from water carriage is only twelve miles, and the location where the work is to be done, is healthy.

The Federal government of the United States proposes to verify the surveys; France and England have been asked to participate.

The necessary grants and treaties have been perfected, by which the route is secured, and a financial plan is now being digested upon which it is proposed to commence and prosecute the construction of the work vigorously.

For the Journal of the Franklin Institute.

Bridge Foundations.—Description of the Mode of Founding the Piers of the Ohio and Pennsylvania Railroad Bridge, across the Allegheny River at Pittsburgh. By Solomon W. Roberts, Chf. Eng.

The city of Pittsburgh and the city of Allegheny are separated by the Allegheny river, which is a stream about twelve hundred feet wide, and which sometimes rises to the height of thirty feet above low water mark. Such great floods are, however, very rare, but a rise of twelve or fifteen feet is a common occurrence, and the current is then very strong. The bottom of the river, to an unknown depth, consists of a mass of gravel, mixed with bolder stones of the size commonly used for street paving, and occasionally containing water-worn stones of a much larger size. The depth of the stream at low water is very irregular, and while at some places the gravel bottom will be dry, at others the water will be from fifteen to twenty feet deep.

The river is badly adapted to the construction of coffer dams, on account of the porous nature of the gravel bottom, through which water readily flows; and because they would be exposed to injury from frequent freshets, even if it was possible to pump the water out of the coffer dams, within any reasonable limits of cost.

In order to make the best connexion between the two railroads, the site selected for the Ohio and Pennsylvania railroad bridge is opposite the passenger station of the Pennsylvania railroad, in Pittsburgh. It also has the advantage of convenient approaches on both sides of the river, without interfering with any valuable buildings. The bottom of the river at the site of the bridge is, however, very irregular, varying in depth at low water, from one foot to fourteen feet.

After the bottom of the river had been carefully sounded, and a correct cross-section made of it; it was determined to found the piers by excavating pits for them, by means of a steam dredging machine working on a boat, and by sinking heavy cribs, or solid masses of large square timber, below low water, on which to start the masonry.

This plan has been carried out with entire success, and with very little difficulty. Several of the piers, which are built of very heavy masonry laid in cement, are now approaching completion, and they show no signs of settlement whatever. The work in the river was begun on the 16th of August, 1854, and the foundation of the fifth pier was put in on the 5th of November following, being less than three months from the commencement of the work. The remaining pier is in shallow water near the shore, and the abutments are both upon dry land. The height of the piers from low water mark to the under side of the bridge superstructure, is thirty-eight feet, and the depth of the timber foundations under two of the piers, is twelve feet.

The pits, as excavated by the dredging machine, varied in depth from five to thirteen feet below low water, the object being to obtain a level and uniform foundation. Each pit was about sixty-eight feet long and twenty-six feet wide on the bottom, and the cost of excavating and removing the gravel by contract, was fifty cents per cubic yard. By the careful use of the buckets of the dredging machine, and occasionally of a heavy iron rake, the bottoms of the pits were made very smooth and even. One large stone which could not be removed by the means at hand, was sunk in a hole dug for the purpose alongside of the pit.

The timber foundations were constructed of white pine timber, sawed square, and one foot thick. They were built afloat in the river, the first course of timbers being twenty-four feet long, and laid side by side, across the line of the pier. The second course crossed the first at right angles, and was bolted to it with iron rag bolts. The third course, bolted to the second, ran in the same direction as the first. In this way an exceedingly strong foundation was constructed of solid timber, three feet thick, and large enough to distribute the weight to be supported over an extensive surface, sixty-six feet long by twenty-four feet wide. The masonry of each pier, at low water mark, is fourteen feet and a half thick, and its extreme length is sixty-three and a half feet, the ends being semi-circular. The top of the timber foundation is eighteen feet three inches broad, and sixty five feet long. After the first three courses of timber were laid, the additional courses were drawn in on the sides, by a succession of stops, so as to reduce the timber work to these dimensions on the top; and the upper course was planked with three-inch plank, on which the masonry was started.

Experience showed that where the water was deep, and the foundations consisted of a good many courses of timber, it was expedient to leave some spaces between the timbers and fill them with stone, so that the whole mass might be but little lighter than an equal bulk of water, in order that the top of the timber foundation might float but little above the water, and be about level with the decks of the flat boats loaded with dressed stone for the pier, which lay on each side of the foundation to steady it. The first course of the pier masonry was thus laid in the most convenient manner, the river being low; and the weight of the stone work sunk the foundation down upon its permanent bed and in its appropriate place. The men were not required to work in the water, and all expense for pumping was avoided.

After the foundations were thus sunk in the manner desired, a large quantity of heavy loose stone, or rip rap, was placed around them, to secure them from the scouring action of the river.

The durability of the timber is secured by its being always under water, and of the permanence of the structure there is no doubt.

Canals and Railways in India. An abstract of paper read before the Royal Society of Arts. By W. Bridges Adams.*

Continued from page 221.

[Mr. Adams then went on to describe the construction of wheels on railways, and their defects, and the essential principles of their improvement. He thus continued:]

It is a common remark by persons of not very logical minds, that a thing is very well in theory, but will not do in practice. If this mean anything, it is that the theory is a false one. A man putting forth a false theory may do so either honestly or ignorantly, and in neither case ought he to be implicitly trusted; but precisely the same remark applies to those who refuse to admit a true theory, or who suffer a true theory to fall dead for want of application. To the clear, perceptive mind, the true theory is as true and certain as the demonstration by practice.

To illustrate the theory of rails which I have set forth, the large model on the table represents a rail of girder form, deep and wide, to give vertical and horizontal strength. The top of the rail is elevated less than 3 inches above the bearing on the ballast, while the width is 13 inches, or a proportion of about 26 to 5 in favor of steadiness. The total depth of the rail is 7 inches; and of this 4½ inches serve as a keel, to give additional steadiness by holding laterally in the ballast. The tie-bars keep the gauge. The packing is very accessible, and the rail is really reversible. The rails and side brackets break joint mutually, and the manufacture is easily producible, and any part can be replaced without much waste. There are but four parts or types, and the commonest laborers can lay them down without error, while the whole is of wrought iron, and there is no timber to rot, and no mechanical work to do on the ground.

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* From the London Artizan, September, 1855.

There are three other models—one of a bracket-joint for a double head-rail, increasing the mechanical efficiency and decreasing the cost; a second model of a similar joint for a mid-ribbed rail, to give lateral stiffness and resistance. The third is a girder rail and joint, to be applied to cross sleepers or to detached blocks. This rail is very stiff, both vertically and laterally. All these are applicable to locomotive lines.

The bridge rail and joint with the tie-bar are applied for laying down on the surface of the ground, or for cross sleepers. The rail is rolled with two lower ribs forming angles, over which the sides are drawn close by the bolts, clipping both rails and tie-bar as firmly as a vice. The rail is thus deepened vertically, and rendered stiffer. The gauge is shown as 2 feet 6 inches. The rail is adapted to lay down without sleepers on the surface of the ground, and may be easily widened by longer tie-bars. There is no timber or sleeper needed, and the rails may be moved at a moment's notice. The firmness of the joints makes the rails practically continuous bars. This rail is perfectly well adapted for horse traction, burying the joints in the ground, and leaving the rails to bear on the surface, or placing detached blocks of wood below them. The wagon-wheels are to be cast sheaves, from 15 to 18 inches in diameter, and a single spring connecting the ends of the axles together on each side. The wagons will carry a load of 30 cwt.; or a lighter rail, on the same principle, may be used to carry 15 cwt. This same rail and joint increased one-half in size, and placed on cross timbers, would make the strongest, firmest, and cheapest of ordinary lines of way. Used without sleepers, it would be found the simplest application for army and fortification lines, perfectly manageable by ordinary soldiery, and also for mineral and for agricultural lines where horses are used.

This bridge rail-joint has now been in successful use upwards of six months on one line, and is about to be laid down on four others. The bracket-joints are laying down on four lines.

Models are shown of these brackets, full size, as applicable both to joint and intermediate sleepers. Mechanically, this arrangement makes the rails much firmer, as they are lowered two inches on the sleeper; the under sides are not damaged by resting on chairs, so that they are really reversible; there are no keys to get loose, and the weight of metal is considerably reduced as compared with the chair system.

An apology may be due for the prolixity of this detail; but upon the specific question of wheels and rails depends the result of profit or loss in railway transit.

And this brings me to a very important consideration of the question at issue. Colonel Cotton compares canals as they are with railways as they are. But there is a manifest distinction. Canals, during the lapse of time from their advent to the present day, appear to have exhausted the fertility of the human mind as to their perfectibility. The only further move is to convert the external haulage of the boats to an internal propulsion. But this needs a size of canal not yet contemplated. But railroads proper have only existed 25 years, and are far from having yet attained their possible perfection. I am not going, after the fashion of

Brother Jonathan, "to draw a bill on futurity and cash it at sight;" but I appeal to any competent and unprejudiced observer who is familiar with the items on railways of "maintenance of way and rolling stock," whether reasons have not been pointed out why there is hope for a very material diminution in cost and working expenses. With this proximate and more perfect result, then, must Colonel Cotton compare the water transit he advocates. We are a "practical" people; so practical, that we have changed the very meaning of the word theorem, and made it to signify a fallacy; so that a man must forego the gift of speech, and demonstrate in materials like deaf and dumb people, ere he can gain credence. He must not set up for a critic till he is prepared with something better than the thing he criticises. For this reason only have I loaded the table with models, which seem almost an insult to common sense, as embodying the merest truisms.

There is yet another question. The canal only follows the course of all the earliest settlements, the streams, and leaves untouched the hidden wealth of the yet desert. The railway opens up mineral and other wealth. It will, if rightly used, form a line of new streets and villages. It will bring squatters from all parts to its borders, just as the opening of the Erie canal gathered together what are called "forwarding merchants" from all parts of the Union. Yet another thing. The line of the river is very commonly unhealthy by its locality. The line of the rail will, probably, be much more healthy. The very rushing of the trains sets the stagnant air in motion.

In discussing whether a canal or railway is best, the discussion must, therefore, not wander all over India, like a desultory tribe of broken men, but must be confined logically and specifically to each given river in succession. Let us know the conditions of the river as to its amount of water at all seasons—the gradients of its bed—the obstacles in its course—soil and climate, and we can deal with the question as a calculation, whether it is desirable to make a railway or not in preference to, or in conjunction with, the river. All generalizing, save as to theory, or laying down principles, is useless, when the question is one of fact, and of specific fact. It is as vague as the celebrated proposition, "Given the height of the Monument, what is the depth of the Baltic Sea?" or, to put it into an American axiom, "It is about as big as a piece of chalk."

Cotton is the staple subject. Let us know in how many localities, and of what extent, cotton grows; and, what is also very much to the purpose, in how many and what sized localities it may be made to grow along the course of the railways *in esse* and *in posse*. Whatever be the amount, there is no doubt that railways can carry it, if not on one line of rails, on two or more; with good gradients, a well-constructed engine, and wagons not damaging to the road, may transport from 100 to 150 tons net at a rate of 15 to 20 miles per hour; and 24 trains a day might follow each other in succession without casualties; in round numbers, a million and a quarter tons per annum. But in such case only one uniform rate of speed could be permitted.

But the real cost of transit on Indian railways cannot be ascertained till a mechanically perfect system shall be adopted, and the fuel procured and manufactured on the spot, and water used in the boilers distilled by the sun, and returned in the form of rain to the Company's tanks, unimpregnated with earthy matters, that destroy the boilers and impede the production of steam. Nor can the railway be properly maintained till provision shall be made for watering the road in dry weather, as well as draining it during rain.

AMERICAN PATENTS.

List of American Patents which issued from September 4, to October 16, 1855, (inclusive,) with Exemplifications.

SEPTEMBER 4.

1. For an *Improved Machine for Electrotyping;* Joseph Alexander Adams, Brooklyn, New York.

Claim.—"The reciprocating or vibrating brush, operated as shown, or in an equivalent way, for the purpose of covering or coating the moulds, for electrotyping purposes, with any proper powdered substance; the said vibrating brush being combined, when necessary, with a carriage, arranged as shown, or in an equivalent way, so that the whole surface of the moulds may be presented gradually or successively to the action of the brush as the moulds pass underneath."

2. For an *Improvement in Mowing Machines;* Collins B. Brown, Alton, Illinois.

"The nature of my invention consists, first, in a peculiar way of attaching the finger bar to the main bar of the machine. 2d, In the peculiar construction of the frame of the machine."

Claim.—"1st, Attaching the finger bar to the bar F of the frame by means of the plates placed each side of the bars near their ends, which overlap each other, the plates being bound or pressed against the sides by the bars by means of screw bolts which pass between the two bars. The ends of the bars having screws or screw bolts passing vertically through them. 2d, Constructing the frame of the machine of two metallic sides, between which the driving wheel is placed, and attaching the bar D to the lower ends of said side pieces, and also the draft pole or tongue."

3. For an *Improvement in Supporting Ships' Topsails;* Thomas Batty, Brooklyn, New York.

"This invention consists in a novel and more effective method of supporting the topmasts and top-gallant-masts of ships and other vessels, which is particularly applicable when standing topsail-yards are employed, but, also, applicable to vessels of the usual rig."

Claim.—"The employment for the purpose of supporting or assisting to support the top-mast or top-gallant-mast and superincumbent spars and rigging, and for setting up the same when necessary, of the two diagonal double screwed iron stays, constructed and applied as described, between the cap of the lower mast and the heel of the top-mast."

4. For an *Improvement in Telegraphic Tide Gauges;* Alexander Boyd, Lumberland, New York.

Claim.—"I do not claim the employment of a float and weight for indicating the height and weight of water in channels or passages, irrespective of the mechanism herein shown, for transmitting motion to the slides, by which the lights are obscured and exposed, for they have been previously used; but what I claim is, showing and obscuring a series of lights, successively, so that the height of the water may be indicated by the number of lights visible by means of the slides provided with projections, and the rod attached to a rope or chain, said rod, operating the slides, the rope or chain working over pulleys, and moved and operated by the shaft which receives its motion by means of the float and weight."

5. For an *Improved Chimney Stack or Cap;* Mortimer M. Camp, New Haven, Conn.

Claim.—"I do not claim either of the parts as such, nor any two of them combined; but what I claim is, the combination of the three parts when constructed, arranged, and combined, as described."

6. For an *Improved Mould for Backing Electrotype Shells;* Aaron D. Farmer and Ransom Rathbone, Brooklyn, New York.

Claim.—"The use of the mould frame B, or its equivalent, in combination with the bed plate A to plate C, and clamps and handle G, or their equivalents, for the purposes substantially as described, for backing electrotype shells."

7. For a *Dovetailing Machine;* John J. Haley, Philadelphia, Pennsylvania.

Claim.—"The forming of a dovetail either as a mortise or a tennon at a single operation by angularly placed reciprocating chisels, *a a*, in combination with horizontally placed chisels *o o*, arranged substantially as set forth. I claim giving a reciprocating motion to the chisels *o o* by the snail cam or shaft, in combination with chisels, gear, and pitman rods, for the purpose of actuating the chisels in unison with each other, in the manner described. Also, the arrangement of the angular guides E E, in combination with the guide E for the purpose of effecting the under cut or sides of the dovetail. Also, the arrangement and combination of the angular guides E E and chisels *a a* on stocks F F, with the horizontal chisels *o o*, and guides *m*, and snail I on shaft H, for producing the dovetail and completing the mortise in the manner set forth."

8. For an *Improvement in Grass Harvesters;* Jonathan Haines, Pekin, Illinois.

Claim.—"I would state that adjustable seat or seats which can be adjusted have been used; but to do this, the machine must be stopped, and the adjustment, when made, is permanent; this I do not claim; but what I do claim is, first, the hanging of the cutter bar to the main frame by means of the longitudinal rods *k* and transverse rods *m*, so that said cutter bar may be free to rise and fall to the undulations of the ground, whilst it is prevented from all lateral motion. Also, the use of a driver's seat when mounted on ways or rails, so that the driver can, at pleasure, throw his weight forward or backward to aid in balancing the machine or in holding or relieving the cutters, as the variable character of the ground or condition of the grass may require."

9. For an *Improvement in Harvesters;* A. E. Kroger, Norwalk, Connecticut.

Claim.—"Attaching the finger bar D to the front bar *a* of the frame A by means of the rods which slide through the ends of the bar *a*, the rods being encompassed by springs."

10. For an *Improved Apparatus to prevent an over supply of Coal to the Fire Box of Hot Air Furnaces;* Lewis W. Leeds, Germantown, Pennsylvania.

Claim.—"The arrangement in the fire chamber of the balance valves, for the purpose of preventing an undue quantity of coal from remaining in the fire-box."

11. For an *Improvement in Consuming Escape Steam as an Adjunct in Heating Furnaces;* Thomas Maskell, Franklin, Louisiana.

Claim.—"The use of escape steam decomposed at a high heat by means of a pipe and bulb, or their equivalent, so placed above the bed of coal, as to admit of its combining readily with the gases eliminated therefrom as an economical adjunct in heating boilers."

12. For an *Improvement in Valves for Regulating Steam Engines;* Philip W. Mackenzie, Jersey City, New Jersey.

Claim.—"1st, The construction and arrangement of the cut-off valve and its seat and the disk, and the application to the said valve of a variable spring, P, or their equivalents, whereby the valve is made to cut off the supply of steam by the action of the current of steam in the passage from the boiler to the engine when it has attained the desired speed. 2d, The employment, in connexion with the cut-off valve, of the piston working in the cylinder, which is provided with a valve *d* and adjustable valve, to prevent the too sudden opening of the said valve, the said piston, cylinders, and valves operating as set forth. 3d, Providing for the opening of the cut-off valve by means of the spring as soon as the slide or other induction valve covers the part of the cylinder, by the employment of a stop to prevent the entire closing of the said valve."

13. For an *Improved Mode of Operating and Dumping Earth Cars;* Richard Ray, Louisport, Kentucky.

Claim.—"The method of operating alternate trucks upon a double railway track by the several devices, as described. Also, the automatic delivery of the loaded cars, constructed as described, by the several devices thereon, in combination with a post situated between the tracks. Further, the device for closing the bottoms of the cars, as described."

14. For an *Improvement in Operating Dumping Cars;* Richard Ray, Louisport, Ky.

Claim.—"The use of the guide bars when in combination with car constructed with the arm."

15. For an *Improvement in Seeding Machines;* C. and G. Stephenson, Plainfield, Massachusetts.

Claim.—"Distributing or conveying the seed from the box x to the conveying spout by means of the tube with plate attached, the tube being secured within a shaft which has a reciprocating rotary motion."

16. For a *Machine for Sawing Hoops;* Elias Strange and Thomas B. Smith, Taunton, Massachusetts.

Claim.—"The employment of two reciprocating saws, arranged as shown, viz: one saw being secured in a laterally sliding sash, and the other in a permanent sash, or one which only has a reciprocating motion in a vertical direction."

17. For an *Improvement in Grain Separators;* J. Van Horne, Magnolia, Illinois.

Claim.—"The revolving cylinder furnished with buckets, flanching, and holes, in combination with the revolving cylindrical screen, for the purpose of cleaning the grain, separating the cob, and elevating the grain, and delivering it in the manner set forth."

18. For an *Improvement in Brick Machines;* John Alexander Victor, Montgomery County, Kentucky.

Claim.—"The combination of the endless chain of moulds connected substantially as described with the two sets of rollers, one of the upper of which, in addition to aiding in drawing the mould through, at the same time compresses the clay in the mould."

19. For an *Improved Fountain Pen;* George W. White, Village of Mt. Vernon, Town of East Chester, New York.

Claim.—"The manner of constructing the holder by having two small tubes one fitting close over the other, the inner tube joined to the main band, and the outer tube having the holder for the pen attached, and having a hole drilled through both tubes on the side that the pen is attached, so that the ink may flow out into the pen, and when the outer tube is turned or revolved around on the inner tube, the holes are turned away from each other and the holder closed; this outer tube to be turned and regulated by means of a small projection on each tube to the place desired."

20. For an *Improvement in Spike Machines;* Amos Whittemore, Cambridgeport, Mass.

Claim.—"Pointing the spike by means of the inclined bed, the advancing roller, the inclined surface, and the pressing roller."

21. For an *Improved Universal Dog for Planing Machines;* Solomon S. Gray, Assignor to self and S. A. Woods, South Boston, Massachusetts.

Claim.—"1st, The arms, in combination with a pivoted clamp, whereby it is rendered rigid when desired. 2d, Placing the screw, which forces up the clamp above the level of the dogs, for the purpose set forth."

22. For an *Improved Locomotive Lamp Case;* Salmon Bidwell, Rochester, N. Y.

Claim.—"The placing of the chimney horizontally and in such a position as to discharge the smoke near the top and behind the lamp."

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23. For an *Improvement in Machines for Cutting Standing Cotton Stalks;* J. W. Bocage, Cypress Hills, Arkansas.

Claim.—"The employment or use of a series of circular saws, placed upon a vertical shaft, and rotating between the bars of a metallic frame; the saws and frame being placed upon or attached to a proper carriage."

24. For an *Improvement in Lantern Guards;* C. H. Butterfield, South Lancaster, Massachusetts.

Claim.—"Making the guard movable by means of the hinges and catches."

25. For an *Improvement in Machines for Sawing Marble;* John Cochrane, Baltimore, Maryland.

Claim.—"The hanging of two saws in one gate at any required angle with each other, in combination with the angular guides, the slides, and the accommodation links, or their equivalents, for the purpose of sawing two inclined or tapering sides of a block of marble or stone at one operation."

26. For an *Improvement in the Method of Securing Keys in Connecting Rods, &c.;* George H. Coney, Boston, Massachusetts.

Claim.—"The combination of a screw nut and a screw divided longitudinally, as a means by which to hold the key in its place."

27. For a *Self-Regulating Valve for Ventilation;* John Clark, Cambridge Township, Pennsylvania.

Claim.—"The air-tight cylinder and bellows (of whatever material they may be made,) for the purpose of obtaining a motive power from the expansion and contraction of the air, and to whatever use it may be applied."

28. For an *Improvement in Machinery for Folding and Measuring Cloth;* Joseph D. Elliot, Leicester, Massachusetts.

Claim.—"1st, In connexion with the pivoted vibrating blades, the rod and swivel for causing said blades to make a half revolution during each vibration. Also, the friction bar or brake, in combination with the rolls for preventing the cloth, by the momentum of the blades, from paying off faster than it is folded."

29. For an *Improvement in Saw Mill Carriages;* Robert S. Eastham, Blanchester, O.

Claim.—"The wedge blocks worked by the rods, and springs for elevating the steadying strips up against the log for holding it steady while being sawed. Also, the combination of the catches attached to the bottom of the wedge blocks and ratchets, for holding the wedge blocks to their place after elevating the strips against the log."

30. For an *Improvement in Harvesting Machines;* John E. Heath, Geneva, Ohio.

Claim.—"1st, Suspending the reciprocating bar by means of the stirrups near the ground in front of or behind the driving wheel, in or near the same plane as the finger board, in combination with the angular friction roller. 2d, The adjustable pressure bar, in combination with the cutter teeth and fingers."

31. For a *Life-Preserving Bed for Ships;* George K. Hooper, Boston, Massachusetts.

Claim.—"My improved manufacture or life-preserving spring pontoon bed is made of a wooden frame or mattress, a series of pontoons and a series of springs arranged and connected together. Also, of making each of the pontoons of less depth at its inner edge than it is at its outer one, or that which is hinged to the frame, when the said pontoon is of such size as to project beneath the shoulder blades of a person when reposing upon the mattress."

32. For a *Charger for Fire Arms, &c.;* Josee Johnson, Washington, D. C.

Claim.—"1st, The combination of the projecting ball, cylinder, and cut-off valve. 2d, Using the clamp, in connexion with the charger, for the purpose of facilitating the rapid completion of the process of loading fire arms."

33. For an *Improvement in Hernial Trusses;* Francis Grace Mitchell, M. D., City of New York.

Claim.—"The mechanical arrangement on the back of the pad on the metal plate, which consists of a lever which presses a steel spring into a longitudinal groove formed in the centre of the metal plate on the back of the pad."

34. For an *Improvement in Hominy Machines;* Jonathan Nesbitt, Jr., and Thomas J. Cosley, Clear Spring, Maryland.

Claim.—"The construction of the beater, the same consisting in a beater provided with four faces, two of which are plane or squared, and two provided with the inclined or screw-like projections. Also, in combination with such beater, the two rows of spurs inserted in its plane faces."

35. For an *Improved Rotary Steam Engine;* Christian E. Offhaus, Newark, N. J.

Claim.—"1st, The construction of the revolving piston in rotary engines with piston valves, said piston valves being made to open and shut by the action of the steam without any extra friction against any part on the inside of the cylinder. 2d, The arrangement of the openings and passages in the side plates, in connexion with the grooves in the cylinder, forming a communication between the inner sides of the piston valves and the steam and exhaust passages alternately. 3d, The construction of the piston valves and frames, and the manner of changing the position of the same when the motion of the engine requires to be reversed."

36. For an *Improvement in Seed Planters;* Freeman Plummer and Gilmore B. Rollins, Manchester, Indiana.

Claim.—"Links, in combination with the adjustable rods."

37. For an *Improvement in Conical Plate Railroad Car Springs;* John J. Speed, Jr., and John A. Bailey, Detroit, Michigan.

Claim.—"Providing the splitting of the edges of the disks by expansion, and effecting free unbroken compensation or lateral play for the radial elongation of the fibre or fibres when the spring is exposed to sudden or heavy compression, and ensuring equality of elasticity all round by making the disks with radial corrugations and arranging them for operation together."

38. For an *Improved Machine for Crimping Paper for Sticking Pins;* J. B. Terry, Hartford, Connecticut.

Claim.—"The use of the hinged clamps, or equivalents, operating together with the folding rod or former to crimp the paper."

39. For an *Improved Method of Operating Reciprocating Saws;* O. S. Woodcock, Connersville, Indiana.

Claim.—"Attaching the lower end of the saw directly to the upper end of the pitman by a pin which forms a joint connexion, the pitman working on a suitable fulcrum or bearing below the pin."

40. For an *Improved Construction of Beds for Shingle Machines;* Henry J. Weston, Buffalo, New York.

Claim.—"Making the yielding bed in two parts."

41. For an *Improvement in Cotton Seed Hullers;* Wm. Wilber, New Orleans, La.

Claim.—"The arrangement of the hopper, revolving toothed cylinders, breast plate, crushing and grinding cylinder, concave bed with removable extended bed plate, and toothed cylinder revolving in its toothed case. Also, the series of graduated blasts and screens for the purpose of separating the oleaginous from the other impurities of the seeds."

42. For an *Improvement in Steam Apparatus for Extracting Vegetable Oils;* Wm. Wilber, New Orleans, Louisiana.

Claim.—"A kettle for steaming or boiling and moistening oleaginous seeds, into which steam is admitted whilst it is surrounded by steam, so that the cooking and moistening be done by the direct and indirect action of steam."

43. For an *Improvement in Grinding Cotton and other Seed for their Oils;* Wm. Wilber, New Orleans, Louisiana.

Claim.—"The application of jets of steam for lubricating the surfaces of cylinders for grinding cotton seeds, to prevent their gumming up or being clogged by the ground material."

44. For a *Double Acting Force Pump;* Thomas J. DeYampert, Mobile, Alabama.

Claim.—"The system of crossed levers and connecting rods when placed and operated in the intermediate or central chamber, and when combined with two or more pistons working in cylinders which radiate from the central axis or fulcrum of said levers."

45. For an *Improvement in Horometers;* Amos Abbott, Manchester, New Hampshire.

Claim.—"An instrument upon which are delineated projections of latitude and longitude within an arc of a circle, combined with the arm and scale, or their equivalent, for the purpose of solving useful problems in spherical trigonometry without the usual mathematical calculations. Also, the employment in mathematical instruments of magnetism, to keep a slide at right angles or any given angle to a straight edge, and at the same time allowing it to slide freely upon the straight edge."

46. For an *Improvement in Knitting Machines;* Walter and Jonas B. Aiken, Assignors to Herrick and James B. Aiken, Franklin, New Hampshire.

Claim.—"1st, The construction of the hollow circular needle plate, having grooves in its outer surface. 2d, The loop regulator."

47. For an *Improvement in Machinery for Trebling a Single Thread;* Anson A. Swift, Assignor to self and Samuel L. Hill, Florence, Massachusetts.

Claim.—"Such improved arrangement and combination of the hitching heads, movable and stationary frames, whereby I am not only enabled to dispense with an endless band and one hitching head, but employ a reciprocating frame, and thereby afford an attendant on the machine the advantage of being near the reeling mechanism."

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48. For an *Improvement in Steam Gauge Cocks;* Albert Bisbee, Chelsea, Mass.

Claim.—"The arrangement of the india rubber disk or facing to the screw plug or stopper, imbedded and bound at its edges by an extension of the body of the plug, with the stationary annular stopper seat of the cock."

49. For an *Improvement in Machinery for Cleaning Cotton;* Samuel W. Brown, Lowell, Massachusetts.

"The nature of my invention consists in more effectually picking and cleaning cotton, by drawing and separating the fine dirt, dust, &c. from the cotton, by exhausting the air and dirt from above the cotton as it is thrown forwards above the secondary feed rolls, and in employing two or more sets of secondary feed rolls to conduct the cotton to the second beater in several different places."

Claim.—"1st, My within described dome, having a rack or grid in the upper portion of it, under which the cotton is thrown by the first beater in connexion with the fan in the exhaust pipe leading from the top of the dome, for exhausting the dust from the cotton as it is thrown forwards by the first beater. 2d, The use and application of two or more sets of secondary feed rolls, in connexion with the beaters, which rolls take the cotton from the dome and deliver it to the second beaters in several different places, so as to completely separate and agitate the cotton, to straighten and even the fibres, and free the dirt from it."

50. For an *Improvement in Mowing and Reaping Machines;* William Burgess, London, England; patented in England, August 16, 1854.

Claim.—"Combining the archimedean screws with the platform thereof, for the purpose of delivering the cut crop off from the same."

51. For an *Improvement in Heaters for Smoothing Irons;* Newell Cleveland and James J. Johnston, Alleghany, Pennsylvania.

Claim.—"The grated (or lattice worked) heater for box smoothing irons."

52. For an *Improvement in Feed Water Apparatus of Steam Boilers;* Joel Densmore, Blooming Valley, Pennsylvania.

Claim.—"The arrangement of the tube to enter the boiler at the water line, with the steam chest and pump cylinder, by which the steam of the boilers assists the pump worked by the engine to force water into the boiler."

53. For a *Machine for Felling Trees;* Thomas Durden, Montgomery, Alabama.

Claim.—"The employment of cutters, in combination with the feeding arrangement. Likewise, providing the jaws of the dog with a projection."

54. For an *Improvement in Corn and Cob Mills;* Rensselaer D. Granger, Philadelphia, Pennsylvania.

Claim.—"The adjustable horizontal guide rollers, in combination with the bridge tree, spindle, and spring, for the purpose of maintaining an uniform relative position of the shell with the bur, and, at the same time, allowing the former to yield from the latter."

55. For an *Improvement in Cutting Wire;* William Grover, Holyoke, Mass.

Claim.—"The use of the circular plate having radial slots formed thereon, for the purpose of holding and cutting wire, together with the gauge."

56. For *Improvements in Looms for Weaving Suspender Webbing;* Wm. V. Gee, New Haven, Connecticut.

Claim.—"1st, The method of forming button holes or other holes in suspender webbing and other fabrics, by weaving one side of the hole continuously from the weaving of the full width of the web, then running back the web the length of the hole, and proceeding with the other side of the hole. 2d, The employment for operating the harness of a sliding carriage furnished with a number of catches corresponding with the number of leaves of harness, said catches being employed below the harness opposite the lifting bars thereof, and being allowed to fall into the notches of the lifting bars of their respective leaves of harness, or being thrown out by a corresponding number of levers, which are operated upon by a pattern cylinder, or its equivalent. 3d, The method of throwing off the levers from the pattern cylinder at every stroke of the loom, to admit of the turning of the cylinder, by attaching all the said levers to a superior lever, which is operated upon by inclined surfaces upon the connecting rod of the lifting carriage. 4th, The mechanism by which the suspension of the operation of that part of the harness which carries that part of the warp which forms the side of the hole which is first woven is effected, consisting of a rock shaft, carrying catches to hold up the harness, and a finger lever attached to the lifting carriage, to act on a cam, or its equivalent, on the said rock shaft, the said finger lever having imparted to it by suitable means, a vibrating or side to side movement at the termination of the weaving of each side of the hole, to actuate the rock shaft to throw the catches in or out of operation. 5th, The method of returning the pattern cylinder to the position for commencing the pattern after the weaving of the hole, by fitting the cylinder loosely to its shaft, and furnishing the end of the shaft with a fixed slide to receive a movable slider, which is raised at intervals by a lever operated by a cam on a shaft parallel to and geared with the cylinder shaft, and at the end of the formation of the hole, suddenly falls over a step on the cam and throws down the slider, and thereby causes a fork in the cylinder, and returns it positively to the required position. 6th, Forming those dents of the reed which correspond with that part of the warp which forms that side of the button hole is to be first woven with a backward crock above or below the plane in which the closing of the sheds takes place, in order, that by raising or lowering that part of the warp of which the first woven side of the hole is composed, the said woven side may be allowed to go back the length of the hole without obstructing the lay in weaving the other side of the hole. 7th, The method of liberating the taken-up roll from the pawls, to allow the backward movement of the web, and re-engaging it with the said pawls by means of the lever, the hooked bar, the catch, and the arm. 8th, Fitting the arm loosely to the take-up shaft and engaging it, by means of a pawl, with the ratchet, and providing a fixed stop to arrest the said arm at a suitable point, whereby the take-up shaft is caused to carry the said arm the requisite distance from the catch corresponding with the length of the button hole, and then the arm to become stationary till the ratchet is liberated, and then to return with the ratchet to throw out the catch. 9th, The application, in connexion with each of the let-off rolls of a brake lever and a spring lever, the said levers operating to control the let-off, and the spring lover acting as a backward take-up to take back the web to weave the second side of the hole."

57. For an *Improvement in Brick Machines;* G. W. B. Gedney, City of New York.

Claim.—"The off-bearing boards as applied. Also, the fingers for placing the board from the mould on to the endless apron."

58. For an *Improved Sawing Mill;* Dean S. Howard, Lyonsdale, New York.

"My invention consists in the manner of setting the log forward any required distance at either or both ends of the ways, by mechanical devices operated by the weight of the log. Also, in the method of hanging and operating the saw, so as to cut from either end of the log, the same way of the grain, the axis of the saw being above the log when cutting from one end, and beneath it when cutting from the other."

Claim.—"The method of setting the log forward after each board is severed, by mechanical devices operated by the weight of the log. 2d, The method of cutting from either end of the log with a circular saw, by hanging the saw in a vibrating frame, or its equivalent, so that the axis of the saw may be above the log when cutting from one end, and beneath it when cutting from the other end, so as to cut either way against the grain of the wood. Also, the self-setting arrangement, whether in connexion with the circular saw or the single or double edged reciprocating saw, as equally applicable to either."

59. For a *Dovetail Key Cutter;* Amos P. Hughes, Philadelphia, Pennsylvania.

Claim.—"The combination of two angular V shaped and adjustable cutters with the guiding tube, or its equivalent."

60. For an *Improved Plane Bit;* Horace Harris, Gorham, New York.

Claim.—"The adjustment of the cap and bit with the grooves at each side, and of the thumb screw at the top of the cap and bit for the regulation of the cut of the bit, while the iron is held fast in the stock by the wedge fastening."

61. For an *Improved Card Printing Press;* Daniel K. Winder, Cincinnati, Ohio.

Claim.—"The combination of the connected chambers of the platen with the spring driver of the bed, for the automatic feed and delivery of cards."

62. For an *Improvement in Lanterns for Locomotives;* James H. Kelley, Rochester, New York; ante-dated June 30, 1855.

Claim.—"The construction of locomotive lamp cases with vertical descending flues open at bottom only."

63. For an *Improvement in Machinery for Picking Fibrous Materials;* Richard Kitson, Lowell, Massachusetts.

Claim.—"Casting or forming the notched plate with locking pieces, for the purpose of entering between the prongs of the teeth into the grooves, which are formed in the cylinder to receive the teeth, and fitting down to the bottom parts or crotches of the teeth, and thus securing them in place."

64. For an *Improved Seal and Stamping Press;* Edmund Morris, Trenton, N. J.

Claim.—"Causing of the frame, which contains the die or plate, to work to and fro on a joint or hinge, so that the latter may be turned over with its face upward in a convenient position to receive a supply of ink."

65. For *Piano Forte Action;* John S. Morton, City of New York.

Claim.—"The arrangement and operation of the lever pivoted to the jack, post, or cushion, and block, with the jack and hammer, to effect the repeat, and whereby, while the use of an additional spring or weight is dispensed with, the weight of the hammer operating on the lever returns the jack to its notch in a position under the butt."

66. For an *Improvement in Fire Arms;* William W. Marston, City of New York.

Claim.—"1st, Elevating the hammer to cock and discharge the piece by means of a cam revolving with the barrels or chambers, and formed with as many points as there are barrels or chambers, so that the hammer shall be raised and discharged by simply rotating said barrels or chambers. 2d, The revolving face plate formed with projections on its face to take the seer, and with notches on its edge taking the stop on the trigger, the two acting to rotate and stop the barrels at the precise point required, and prevent the strain on the trigger from turning the barrels too far. 3d, The mode of constructing and fitting the parts of the cam, face plate, trigger, seer, and stop, so that the hammer shall be cocked by one, two, or more pulls on the trigger, and then discharged by another slight pull of the trigger."

67. For an *Improvement in Revolving Fire Arms;* Frederick Newbury, Albany, N. Y.

Claim.—"The method of operating an oblique toothed ratchet wheel by the direct action of the upper limb or cam end of the trigger, which trigger, also, by the same action, cocks and discharges the hammer and holds the cylinder firmly in place during the firing of the piece. Also, the employment and use of a slot in the trigger for the traverse of its centre pin or axis, in combination with the action of the trigger directly upon the hammer, in order to enable the trigger to replace itself behind the hammer as before the discharge of the same. Also, the apparatus for attaching and detaching the barrel to the stock, to wit, the catch lever lying in the stock underneath the cylinder, with its hook, and finger piece, and spring, together with the recess and stop in the block."

68. For an *Improvement in Safety Apparatus for Steam Boilers;* John M. Reeder, Nashville, Tennessee.

Claim.—"Connecting the valve stems, so that the valve may be raised by hand from the outside to flood the fires, but cannot be weighted from the outside to increase the steam over a given quantity."

69. For an *Improved Instrument for Determining Latitude and Longitude;* John Stinson, Danville, New Jersey.

Claim.—"The use of the circle with its shaft or handle provided with the cross piece G and the cross piece, H or their equivalent, the whole being suspended from, at, or near the centre of the circle by means of the plumb wire and rod, which rod is jointed, so as to move freely in a plane passing through the axis of the circle."

70. For an *Improvement in Cooling Cast Iron Car Wheels;* John M. Sigourney, Watertown, New York.

Claim.—"The arrangement of the mould, chill, and ring, for equalizing the cooling of the car wheel."

71. For an *Improvement in Knitting Machines;* Clark Tompkins and John Johnson, Troy, New York.

Claim.—"1st, The manner in which we cause the frame which carries the take-up mechanism to revolve in the same direction and with the same velocity as the needle cylinder. 2d, Combining the web shaping plates with the take-up mechanism."

72. For a *Preparation of Metallic Plates for Printers;* Samuel W. Lowe, Philadelphia, Assignor to self and Jacob M. Beck, Harrisburgh, Pennsylvania.

Claim.—"Coating the plain or unengraved face or surface of the plate (which is intended for leaving the white or unprinted surface of the paper) with a mercurial amalgam, that will have the effect of preventing the ink used in printing therefrom from adhering to or soiling the same, whilst the figures engraved or etched thereon readily receive the ink, and thus admit of printing from the plate in the same "form" with the type, without the "wiping" heretofore required in printing from steel or copper plates. Also, the coating the plane surface of etched or engraved steel plates with an alloy of tin and mercury; and also, the coating of etched or engraved copper plates in the same manner and for the same purposes; and the coating of the plane surface of metallic embossing plates in the same manner, and for the more special purpose of using the sunken parts when filled up with a resinous substance as a plate to print from, thus saving an extra color plate when it is desired to have the parts to be embossed first printed in any color."

73. For an *Improvement in Curtain Fixtures;* Peter H. Niles, Boston, Assignor to Ralph C. Webster, Watertown, Massachusetts; ante-dated March, 18, 1855.

Claim.—"The combination of the bracket, having a hole of double diameter with the spring pin and the roller end, either with or without a spool thereon, fitted to correspond to said hole, and dispensing with the knob or cap on the other end of the roller."

74. For an *Improvement in Cooking Stoves;* John Van, St. Louis, Missouri.

Claim.—"The arrangement of the water cylinder with separate chambers, fire cylinder or space in its centre opening through its top, and cross and heating tubes combined."

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75. For an *Improved Apparatus for discharging Reservoirs, &c.;* Daniel Bedford, City of New York.

Claim.—"The mode of hanging and balancing the valve, by means of the lever and its appurtenances. Also, in combination therewith, the float for closing the valve, when the whole contents of the receptacle are discharged."

76. For an *Improvement in Machines for Sawing Stone;* C. G. Bietel and H. J. Brunner, Nazareth, Pennsylvania.

Claim.—"The combination of the flexible saws, rollers, adjustable radial ways, and concentric grooves or ways, whereby the saws are enabled to run at different angles, and their open ends to approach and separate, without affecting the degree of their tension."

77. For an *Improvement in Fire Arms;* Frederick Beerstecher, Philadelphia, Pa.

Claim.—"Constructing the head of the hammer of fire arms of this description, so that the part of the head which discharges the forward load, shall be capable of being turned down, for the purpose of allowing the shorter part of the head to strike the rear tube only; and so, that when turned up, it shall strike the forward tube only, without the use of the intermediate covering lever heretofore required, for the purpose of preventing the explosion of the rear cap, in fire arms of this description."

78. For an *Improvement in Pressure Stoppers for Chain Cables;* James Emerson, Worcester, Massachusetts.

Claim.—"The arrangement of the jaw, hinged at its one end, and having a pawl at or near the other, with the bed plate, for operation together."

79. For an *Improved Method of Regulating Length of Stroke in Mortising Machines;* Ezra Gould, Newark, New Jersey.

Claim.—"Attaching the connecting rod to a curved slotted arm, by means of the plate and pin; the plate working in the slot in the pulley and the arm, operated by means of the gearing."

80. For an *Improvement in Coffee Pots;* Joshua E. Hall, Cleveland, Ohio.

Claim.—"The conical tube, with the knob and aperture, which serve as its continuation; this I claim in combination with the reservoir."

81. For an *Improvement in Rakes for Reaping Machines;* Thomas N. Lupton, Winchester, Virginia.

Claim.—"The construction of an automatic rake, having a revolving tubular or sleeve socket, with a revolving extension, or reciprocating piston rod, a slide socket with a sliding arm, and a geared rake device, in combination with the collar."

82. For an *Improvement in Wrench;* Henry J. Behrens, City of New York.

Claim—"The employment of an eccentric toothed on its periphery, and held down by a spring, in combination with the smooth bar wrench."

83. For an *Improved Method of Actuating Gas Engines;* William Mt. Storm, City of New York.

Claim.—"Operating an engine by the agency of water, charged with a gas permanently uniform at ordinary atmospheric temperatures and pressures, and over which water has a self-acting power of absorption, when the process consists in passing a given quantity of the gas set free in charges, under pressure by heat through the engine actuating its piston, and thence to a closed cool and wet vessel, while contemporaneously therewith, I cause to pass to said vessel a sufficient quantity of the same water which had just previously held the gas absorbed to re-absorb it; both water and gas being cooled meanwhile, by means specially provided, to an extent sufficient to cause their re-combination in the original form of gas-charged water, by all of which means the motive power of the gas is obtained, without the necessity of converting the water into steam, while at the same time the gas is thereby re-concentrated and preserved for re-use without entailing an accumulation of water in the heating or separating vessel, or an accumulating pressure of free gas in the cold receiver."

84. For an *Improvement in Corrugated Beams;* Richard Montgomery, City of New York.

Claim.—"A supporting beam formed of sheet metal of unequal thickness, bent into a series of folds."

85. For an *Improved Awning for Horse and Dray;* Jacob Nelson, Cincinnati, Ohio.

Claim.—"The portable and reversible dray and horse canopy, whose poles are hinged at one end to posts, and supported in either the forward or backward position, by branches or brackets projecting from the posts."

86. For an *Improvement in Ships' Rudders;* John S. Robbins, San Francisco, Cal.

Claim.—"Arranging the two rudders and combining them by means of arms and connecting rods."

87. For an *Improved Machine for Cutting Ornamental Mouldings;* H. and Richard S. Schevenell, Athens, Georgia.

Claim.—"The combination of the reciprocating gate or slide, rotary patterns, and the inclined planes or wedges."

88. For an *Improvement in Optical Instruments;* Robert B. Tolles, Canastota, N. Y

Claim.—"Constructing the eye piece in such a manner, that when placed at a proper distance within the focus of an object glass, its anterior refraction shall be properly that of a concave lens."

89. For an *Improved Hold Back for Carriages;* Alonzo Webster, Montpelier, Vt.

Claim.—"The dovetail groove, the dovetail slide, and the spring."

90. For an *Improvement in Leather Finishing Machines;* Charles Weston, T. F. Weston, and John W. Weston, Salem, Massachusetts.

Claim.—"A machine for finishing leather, in combination with the soft elastic bed and elastic finishing tool, the cord secured to the tool stock, for the purpose of keeping the tool clear of the leather, during its retrograde movement over the bed."

91. For an *Improved Boring Machine;* A. Wyckoff and E. R. Morrison, Elmira, N. Y.

Claim.—"1st, The employment or use of the tubular or hollow auger. 2d, The combination of the tubular or hollow auger and worm or screw."

92. For an *Improvement in Bedsteads;* William White, Portsmouth, Virginia.

Claim.—"The jointed parallelogram of bars provided with rods, or their equivalents, which extend to the bedstead at several points and are secured thereto and tightened."

93. For an *Improvement in Trip Hammers;* Peter L. Weimer, Reading, Pa.

Claim.—"The arrangement of the hub or centre piece, the pawls, the interior ratchet ring, the lined metallic strap, the hand wheel, and the post."

94. For a *Machine for Making Printers' Types;* Samuel S. Weed, Stoneham, Mass.

Claim.—"The combination and arrangement of the stationary body or bed die, the bottoming die, and receiving orifice. Also, the combination of the feeding lever, the nipper, and the rod provided with shoulders, the whole being for the purpose of feeding the type rod into the mechanism, or its dies."

95. For an *Improvement in Flouring Mills;* D. S. Wagener, Penn Yan, N. Y.

Claim.—"The arrangement of tubes, connected by the supplemental shoe within the air-tight chamber."

96. For an *Improvement in Artificial Legs;* John Taggart, Roxbury, Mass., Assignor to self and Theodore Parker, Boston, Mass.

Claim.—"Making the leg and foot without any ankle joint. Also, combining together and with the foot, the part and the thigh case, the two springs, so as to operate therewith."

97. For an *Improvement in Ships' Windlasses;* John B. Holmes, Assignor to self and John R. Pratt, City of New York.

Claim.—"The arrangement of the shaft, with its gearing wheels and clutch coupling, in relation to the drums of the windlass, and their gearing, whereby the one or both drums may be moved with a quick or with a slow motion; or the one drum may be moved with the quick, and the other with the slow motion, at the same time."

RE-ISSUES FOR SEPTEMBER, 1855.

1. For an *Improvement in Air-Heating Stoves;* J. M. Thatcher, Jersey City, N. J.; patent dated March 23, 1852; re-issue dated Sept. 11, 1855.

Claim.—"Making the bottom plates of the flue spaces of air heating furnaces or stoves, for the passage of the products of combustion outward or inward, among or around the air passages, inclining inward and downward, toward the fire chamber, for the purpose of facilitating the increase of the heating surface, without the inconvenience of the accumulation of ashes, soot, and other solid matter on such plates. Also, the combination of the inverted domes or frustrums and plate, with the short tubes connecting them, for the purpose of effecting the connexion between the lower ends of the fire or draft flues, and carrying the air through them, to the spaces between the cylinders or tubes."

2. For an *Improvement in Grain Dryers;* John Massey, City of New York.; patent dated April 17, 1849; re-issue dated Sept. 11, 1855.

Claim.—"In the method of kiln drying grain, the employment of an endless pan, or apron, made of metal, and passing around drums, or the equivalents thereof, in combination with, and operated within, a heating chamber."

3. For an *Improvement in Pumps;* Levi P. and William F. Dodge, Newburg, N. Y.; patent dated June 7, 1853; re-issue dated Sept. 25, 1855.

Claim.—"The combination of the cylinder or chamber and the piston with its valves and the induction and eduction passages, so that the water all entering said cylinder, under pressure alternately at its ends, is discharged under pressure through the opening at its side, producing a constant and direct stream through the piston heads from the cylinder; thus dispensing with chambers and partitions in the barrel and valves at the eduction port, preventing leakage, and rendering the pump more simple and effective, and less liable to derangement."

DESIGNS FOR SEPTEMBER, 1855.

1. For *Trade Marks;* Thomas Lewis, Malden, Massachusetts; dated Sept. 4, 1855.

Claim.—"The ornamental design or trade mark, to bo fixed on articles of manufacture and formed without the padlock."

2. For *Cooking Stoves;* William T. Coggeshall, Fall River, Massachusetts; dated Sept. 4, 1855.

Claim.—"The ornamental configuration of the base, cornice, and edge of the main hearth, constitutes one feature; so, in regard, not only to the peculiar base relief star ornament, or collection of rays applied to each of the lesser doors, but to that figured on the main oven door. The bas-relief upon each foot, is also a part of the design; the whole combined with the mouldings and panels constituting the design."

3. For *Table Castors;* Edward Gleason, Dorchester, Mass.; dated Sept. 11, 1855.

Claim.—"The wreath on the circular projection, and the embellishments on the doors and feet."

4. For *Parlor Grates;* James Andrews, Assignor to Andrews & Dixon, Philadelphia; dated Sept. 11, 1855.

Claim.—"The design for parlor grates."

5. For *Stoves;* James H. Conklin, Peckskill, N. Y., Assignor to Samuel B. Sexton, Baltimore, Maryland; dated Sept. 11, 1855.

Claim.—"The design, configuration, and arrangement of the ornaments in bas-relief on stove plates."

6. For *Ovens of Cooking Stoves;* George W. Chambers, Troy, N. York., Assignor to Peter A. Palmer, Leroy, New York; dated Sept. 18, 1855.

Claim.—"The ornamental design and configuration of the side and end plates of an elevated oven of a cook stove."

7. For *Cast Iron Monuments;* J. H. Wilson, Chesterfield, Ill.; dated Sept. 18, 1855.

Claim.—"A design for a cast iron monument for the head of graves, combining the figures of the harp and heart, with a recess for the insertion of a miniature likeness and inscription, and a locket for hair."

OCTOBER 2.

1. For an *Improvement in Preparing Materials for Hat Bodies;* Peter Arneson, Jorgen Pederson, and Hans Rees, City of New York.

Claim.—"1st, The combination with a feed box having adjustable partitions therein, so that the material to be used may be proportioned in quantity, in its different apartments the machinery for taking it therefrom, and thoroughly mixing it in said proportions, preparatory to its being used in hat bodies. 2d, The combination of the two cylinders and plate, the cylinders having serrated plates attached to its periphery, and the plate provided with a serrated edge. 3d, The combination of the box, provided with the endless apron, the shell, and conical head, with the wings or blades at its end. whereby the materials are thoroughly mixed, and discharged from the machine in a loose and light state, and may be delivered without any handling to the next machine."

2. For an *Improvement in Machinery for Manufacturing Hat Bodies;* Peter Arneson, Jorgen Pederson, and Hans Rees, City of New York.

Claim.—"1st The combination of the endless aprons, cylinders and plate, and brush cylinder, for the purpose of feeding the material in a proper state, to the series of cylinders and the formers. 2d, The weighing apparatus, formed of the levers, ring, and weight, when the weighing apparatus is so arranged, that the former while in motion, and the fur is being thrown upon it, may rest upon the weighing apparatus, and the former exhaust and fur, by their weight counter-balance or raise the weight, when the proper quantity of fur has been thrown upon the frame, to form a hat body. 3d, The guides or conductors, constructed of india-rubber, and provided with the adjustable frames at their outer ends, said frames being provided with set screws. 4th, The employment or use of the slide or cut-off, and the movable bed-piece or platform, for the purpose of regulating the blast, and stopping the supply of fur to the former."

3. For an *Improvement in Corrugated Reflectors;* Bernard Goetz, Philadelphia, Pa.

Claim.—"A reflector having the peculiar form of grooved or fluted undulating surface, and the converging grooves, and crossed transversely, by the other series of parallel grooves."

4. For an *Improvement in Sewing Machines;* James Harrison, Jr., Milwaukie, Wis.

"This invention relates to that description of sewing machines, in which the seam is formed by the interlacing of two threads, which are carried through the material to be sewed, from opposite sides thereof, in the form of loops, by two needles arranged obliquely to the material, and operating by turns, each to pass its loop through the loop previously passed through the material by the other; such machine being generally known as the 'Avery sewing machine.'"

Claim.—"1st, In combination with the giving of the two needles, such a movement as will cause both at once during every revolution or stroke of the machine, to be withdrawn from the cloth, for a sufficient time to effect the feed movement, the employment of a supplementary needle, to supply the place of the needle which operates first after the feed movement, and to retain the loop in the thread, which has been put through the cloth by the needle which last leaves the cloth, before the feed movement, until the first named needle operates to pass through the said loop. 2d, The attachment of the clamps which hold the material to be sewed, to two swinging guide plates, or their equivalents, which serve also as guide plates to the needle bars, and thereby cause the needles and the clamps to swing together, whereby the clamps are enabled to accommodate themselves to different or varying thicknesses of material, and to be opened to slacken their hold upon the material, during the feed movement, and the needles are enabled to be kept in a proper or desirable relation to the clamp. 3d, The connexion of the two swinging guide plates, or their equivalents, whereby one of them is caused to have a movement so much greater than the other, that the relative movements of the needles and clamps shall be such, that the needles in all positions of the clamps will cross each other in the plane of, or as near as is desired, to the plane of the face of one of the clamps which is the plane of one surface of the material."

5. For an *Improvement in Screw Wrenches;* Joseph Hyde, City of New York.

Claim.—"The eccentric shaft and thumb piece, as they are arranged in relation to the screw of the movable jar, so that the screw may be thrown in and out of gear with the bar, and the jaw be moved, by sliding it on the bar, or through the turning of the screw."

6. For an *Improved Feed Motion for Planing Machines;* Seth C. and Westel W. Hurlbut, Bloomville, New York.

Claim.—"The application of the worm wheels, in connexion with the spur wheels attached to the shafts of the feed rollers, to effect their proper revolution, and to admit of their opening apart, to receive various thicknesses of lumber."

7. For an *Improvement in Steam Boilers;* Charles Moore, Trenton, New Jersey.

Claim.—"1st, Limiting the circulation of the water in a steam boiler, by means of a partition, so constructed as to separate the fire over the water, or some portion of it, or the water which is highly heated, or that which ascends through the tubes, from mixing with the water around the sides of the boiler, which is at a lower temperature, and thereby preventing it from descending, so as to enter the tubes again at the lower ends. 2d, So constructing and arranging the tubes in the fire space, that the burning fuel will surround the horizontal parts of the tube, and a portion of the perpendicular parts. 3d, Extending the tubes downwards, which pass through the fire space, after they leave said space, and terminating their perpendicularly in the water space, so as to prevent or retard the water, which is highly heated, or the steam generated in the tubes from escapeing from the lower ends."

8. For an *Improved Chimney Stack;* Benjamin F. Miller, City of New York.

Claim.—"Constructing and placing a solid or hollow cone, or a pyramid, in the mouth of the funnel or smoke stack, with its apex upwards, or pointing outwards from the mouth of said chimney or pipe, in combination with the surrounding shield, furnished with flanches."

9. For an *Improvement in Knitting Machines;* Joseph Powell, Waterbury, Conn.

Claim.—"1st, So combining two sets of needles, such as are commonly employed on knitting frames, that they may be brought into joint action, and have loops formed on both of said sets, at one and the same time, and thus form a ribbed fabric. 2d, The arrangement of the needle bars and the two pressure bars, so combined, that when both sets of needles are in action, both pressure bars will also act upon the barbs of the needles. 3d, The self-setting latches, in combination with the needle and pressure bars. 4th, The combination of the regulating bar with the shifting bar and the set screw, for regulating the throw of the sinkers and depth of the loops. 5th, The manner of discharging the loops, that is to say, casting off those of one set of needles, a little in advance of those of the other set, and giving to the first set of needles an upward motion, as soon as the cast-off has been effected from them, for the purpose of relieving the strain."

10. For an *Improvement in Ships' Pumps;* Samuel Pearn, City of New York.

Claim.—"The combination of the two series of oppositely inclined conical pipes, when the small ends of the pipes of one series are inserted and project within the body of the pipes of the other series, and vice versa, with sufficient space around the inserted ends, for the return of the water, as the apparatus is vibrated alternately in opposite directions."

11. For a *Clock Escapement;* E. K. Reynolds, City of New York.

Claim.—"Constructing the staff of the balance, with a spiral groove, and so arranging the balance, that the point of the lever will work in the said groove, and give the requisite motion to the balance."

12. For an *Apparatus for Opening and Closing Hatchways;* Henry Sizer, City of New York, and Elisha Stone, Lowell, Massachusetts.

Claim.—"1st, The chain wheel, the chain, the rack, the doors with segments of gears or whole gears attached to them, and the gear for the purpose of opening and closing hatchways or scuttle doors. 2d, The parts before mentioned, either or all of them, in combination with the cylinder, the rope wheel, and the gears, for the purpose of opening and closing the doors of scuttles or hatchways."

13. For an *Improvement in Moulding Circular and Undercut Work;* William Sellers and James Walker, Cincinnati, Ohio.

Claim.—"The method of moulding circular undercut work."

14. For a *Coopers' Crozing-Plane;* Hiram and John C. Taylor, Cincinnati, Ohio.

Claim.—"Casting the stock in one piece, and combining therewith a wedge."

15. For a *Machine for Preparing Rattans, &c.;* Charles C. Reed, Assignor to self and William S. Reinert, Philadelphia, Pennsylvania.

Claim.—"1st, The construction of the adjustable table or plate, with the upright feeding and guide rollers, for enabling the upper surface of said table or plate to be graduated to the grooves in the rollers. 2d, Arranging the adjustable side bars, in such relation to the upper and lower parts of the flexible portions of the springs, as to enable them to be graduated, so as to arrest the outward movement of the lower flexible portions of said springs, at such points as to allow the rollers to yield sufficiently to receive and embrace the rattan between them, and yet prevent one of them from moving further from the centre than the other, so as to keep the rattan, at all times, in the centre groove,

and at the same time, allow a slight and stiff elastic movement to the upper portions of the springs above the bars, to allow either of the rollers to yield to the inequalities on either side of the rattan."

16. For a *Thermo-Udoric Filter;* Gustavus Weissenborn, Assignor to Epes W. Sargent, City of New York; patented in England, Nov. 17, 1854.

Claim.—"The method of separating impurities or mineral substances from water, by so introducing steam and water into a suitable apparatus, that they shall commingle, and the water thereby be heated, to fall in a shower upon, or be brought in contact with, pebble stones, twigs, bushwood, or other suitable substances or surfaces, whereon said mineral matter or impurities will be deposited."

17. For an *Improvement in Machinery for filling Seine Needles;* Humphrey M. Glines, Assignor to John M. and Simon F. Stanton, Manchester, N. H.

Claim.—"Giving the needle a rotary motion around its own centre, both horizontally and transversely, by means of devices described, or their equivalents, in combination with a vibrating delivering arm, or its equivalent, so constructed, arranged, and operated, as to supply and deliver the twine or other material to the aforesaid needle."

OCTOBER 9.

18. For an *Improvement in Sewing Machines;* C. J. Cowperthwaite, Philadelphia, Pa.

Claim.—"The weighted trip lever, applied to the bar, or its equivalent, which holds the cloth, so as to serve not only to apply pressure to the cloth, but to hold up the said bar, or equivalent, from the cloth when desired; also, to allow the said bar, or equivalent, when its foot is struck by the needle bar, while it is held up, to descend and to hold it down again, until it is lifted by the operator. 2d, Arranging the shuttle race obliquely to the direction in which the cloth is moved, to produce the seam, or line of sewing, for the purpose of causing the visible parts of the stitches on the front or upper side of the cloth to be straight, or all in the same line."

19. For a *Machine for Gauging, Measuring, &c., Staves;* Larkin T. Atkins, Page County, Virginia.

Claim.—"The combination of treadles, clamps, and vibratory arms or levers, operating as set forth."

20. For an *Improvement in the Manufacture of Acid Sulphite of Limes;* Phillippe L. Bernard and Joseph Albrecht, New Orleans, La.

Claim.—"The apparatus for the manufacture of sulphite and bi-(or acid) sulphite of lime, consisting of the oven, the three superposed cylinders, and the ventilator."

21. For an *Improvement in the Manufacture of Borax, from Native Borate of Lime;* Thomas Bell and Henry Scholefield, South Shields, England; patented in England, July 25, 1854.

Claim.—"Our mode of manufacturing borate of soda from borate of lime, the same consisting in boiling the borate of lime in water, and an acid separating the lime and other foreign matters, adding a saturated solution of soda to the liquid, boiling the compound, separating the impurities or foreign matters therefrom, and subsequently evaporating the clear liquor, and crystallizing out the borax therefrom."

22. For an *Improvement in Corn Shellers;* Charles Bishop, Norwalk, Ohio.

Claim.—"In combination with a shelling disk or wheel, the series of ear boxes, radially arranged around it, said boxes being composed of elastic backs and unyielding partitions."

23. For an *Improvement in Washing Machines;* John A. Bills, Troy, N. Y.

Claim.—"The movable partitions."

24. For an *Improvement in Preparing Vegetable Fibre;* Jean Blanc, New Orleans, Louisiana.

Claim.—"The staking of the plants buts down, in a pit dug for said purpose, and surrounding them with dry leaves or straw, with earth thrown around the same, thereby enclosing them entirely on all sides, leaving the top open and uncovered."

25. For an *Improvement in Cut-off Valves for Oscillating Engines;* Henry E. Canfield, City of New York.

Claim.—"The arrangement in oscillating engines of separate loose valves, moving independently of each other, when the motion is given them by the oscillation of the cylinder, for the purpose of cutting off the steam, at such part of the stroke as may be desired."

26. For an *Improvement in Churns;* John G. Dungan, Steubenville, Ohio.

Claim.—"Giving the outer leaves of an alternately opposite rotating agitator, a rocking motion, to and from the sides of the churn."

27. For an *Improved Apparatus for Heating Buildings by Steam;* Charles Davenporte, Watertown, Massachusetts.

Claim.—"The arrangement of the vessel, and its connecting pipes and valve, the supply cistern, the boiler, the radiator, and the leading steam and return pipes of the said boiler and radiator."

28. For an *Improvement in Corn Shellers;* Stephen Elliot, Wayne County, Indiana.

Claim.—"The combination of the screws, with the clamping jaws."

29. For an *Improvement in Cotton Gins;* H. H. Fultz, Lexington, Miss.

Claim.—"Giving the cotton to be ginned, within the feed box and directly over the saws, a spiral or twisting motion, by means of the plates or an equivalent device, so that the cotton will pass from one end of the feed box to the other, and have a fresh surface presented successively to the action of the saws as it passes over them."

30. For a *Wind Regulator for Organ Pipes;* Daniel George, Nazareth, Pa.

Claim.—"Constructing the lower part of each or any of the pipes of an organ with a traverse seat, fitted with a plug, like that of a faucet, having a suitable passage or passages, the area of which is regulated by turning the plug, for the purpose of regulating the tone of the tube and tuning the instrument."

31. For an *Improvement in Vibrating Pumps;* Ellwood Garrette, Wilmington, Del.

Claim.—"The arrangement of the side passage, with its openings into chambers respectively, in combination with the vibrating pistons, having their valves opening upwards, or in the direction of the outlet of the water."

32. For an *Improvement in Grain Separators;* Peter Geiser, Smithsburg, Md.

Claim.—"The vanes within the fan case, against which the blast acts, for the purpose of closing or opening the register, automatically, to regulate the blast. Also, the manner of separating the grain from the straw and other impurities, by means of the aprons, vents, and grooved rolls, without the use of a riddle, whether one, two, or more sets of such separating apparatus be used. Also, in combination with the separating apparatus, the self regulating dividing shelf, upon which the grain drops, for the purpose of carrying the heavy grain back, and the lighter forward; for a second or more complete separation. Also, the hinging of the upper to the lower portion of the straw carrier frame, and providing it with adjustable slides or conveyors, for dividing and conveying the straw into any desired localities."

33. For an *Improved Amalgamator;* Samuel Gardiner, Jr., City of New York.

Claim.—"1st, The the hollow perforated rollers, receiving water at their journals, and discharging it in small streams all over their peripheries, and revolving in opposite directions in a trough or troughs of quicksilver, so that their upper parts are constantly approaching each other, and having the auriferous and other metaliferous matter fed above or between them. 2d, The employment of the amalgamating rollers and the distributing rollers and trough, whereby the matter is fed equally, on both amalgating rollers, and on the descending portion thereof."

34. For an *Improvement in Portable Boring Engines;* Thomas Goodrum, Providence, Rhode Island.

Claim.—"1st, Conducting the steam to the engine through a pipe, which is fitted to slide within another pipe, whereby the weight of the engine may be supported by the pressure of the steam. 2d, The employment of two or more sliding pipes of different sizes, one within the other, in combination with suitable clamps, for the purpose of securing all but such one of the said pipes, whose area acted upon by the working pressure of steam, will receive an aggregate pressure, about equal to the weight of the engine."

35. For a *Machine for Making Envelopes, &c.;* E. W. Goodale, Clinton, Mass.

Claim.—" 1st, The employment in a machine for making envelopes or bags, to support the blanks during either or all of the operations of pasting, stamping, and applying the gluten of a self-adjusting table, supported by a cam, whose position is so controlled, by a spring, or its equivalent, applied to its shaft, that as the blanks are removed, one by one, the table is caused to rise, to bring the next one to the proper height or position, to be pasted, stamped, or have the gluten applied. 2d, Giving the self-adjusting table a drop movement, by means of the cam, the lever, pawls, ratchet wheel, or their equivalents, acting on the shaft of the supporting cam. 3d, Applying the gluten which makes the envelope or bag, self-sealing to that part of the blank which is to form the seal flap or closing flap of the envelope or bag by a die, while in the machine at the commencement of the process, whereby the said die serves the two purposes of applying the gluten and of lifting the blanks one at a time, from the pile, or retaining the top one, while the remainder of the pile is lowered away from it. 4th, Applying the two dies to two arms, or jaws, which are connected together by a hinge, or its equivalent, arranged at the rear of the table, and have a sliding motion, back and forth, to move the said dies out of the way of every successive blank, till the latter has had the gluten applied and been separated from the pile, and then to bring them forward again, to receive the separated blank and to receive the pressure of the screw, or its equivalent. 5th, Attaching the paste box, the gluten die and the screw, or other equivalent device, which gives pressure to the stamp, which produces the seal to a head, receiving such a motion as described from a pair of cranks, or their equivalent. 6th, The employment of a pair of nippers, having a motion of a positive length, in the line parallel with the line in which the blank is required to move, from the pasting to the folding apparatus, either to take a cut blank from a table, or to draw the material before it is cut, from a roll, and measure off the proper length to be cut. 7th, The method of giving the necessary movement to the lappers, by means of the bent levers and the springs applied to their hinges. 8th, The creasing fingers, to hold the blank in position, and crease it in the line for holding the seal flap. 9th, The nippers arranged and operating in a lateral direction, to remove the finished envelopes or bags, at one side of the folding stand. 10th, The lifter, applied to the folding stand, and operated by the lever which carries the nippers, for the purpose of lifting the finished envelope or bag, at one side thereof, from the stand, to enable it to be taken by the nippers. 11th, Applying a stamp to work through the table, for the purpose of stamping a card, or other on a bag, during the process of manufacture. 12th, The general arrangement and combination of the several working parts of the machine."

36. For an *Improvement in the Variable Exhaust of Locomotive Engines;* Samuel L. Hay, Reading, Massachusetts.

Claim.—" The application of a self-regulating and adjustable blast pipe, to a locomotive engine."

37. For an *Improved Fish-Hook;* Job Johnson, Brooklyn, New York.

Claim.—" The method of catching fish, by means of a cluster or spider of hooks, beneath and around suitable bait, so that said hooks can be suddenly raised up, and catch the fish, while nibbling at the bait. Also, the method of attaching and hanging the hooks, from the ends of the spider arms, by means of the spring throat, whereby said hooks can be varied or replenished."

38. For an *Improvement in Apparatus for Washing and Bleaching Fibrous and Textile Substances;* Julius A. Jillson, of Poughkeepsie, N. Y., and Henry Whinfield, City of New York.

Claim.—" Combining with the washing, extracting, or receiving chamber, the double acting force pump, and the disinfecting or bleaching vessel."

39. For a *Machine for Making Wire Dish Covers;* William Lincoln, Oakham, Mass.

Claim.—" The combination of rotary forming and holding dies, with beading mechanism applied to operate therewith. Also, the guide spindle, in combination with the cup die and follower. Also, the carriage, the guide, the gearing and shaft, as combined with the dies and the beading mechanism. Also, combining with the cup die, the movable gauge top."

40. For an *Improvement in Economizing Steam*; George M. Longacre, New Orleans, Louisiana.

Claim.—"The employment of two sets of boilers, having steam of different pressure and temperature therein, and passing the steam from the boiler of the highest pressure through the pipes of the evaporators, &c., to the other boiler, from whence it is used to move the machinery of the mill."

41. For an *Improvement in Ploughs*; Harrison Norton, Farmingham, Maine.

Claim.—"Attaching the share to the mould board and "land side" of the plough, by a hinge or joint, and moving said share by means of the bar and lever, or their equivalents."

42. For an *Improvement in Radiators of Steam Heating Apparatus*; A. S. Pelton, Clinton, Connecticut.

Claim.—"The arrangement in a chamber exterior to the escape valve, of a porous packing, for preventing noise, during the escape of steam from the heater. Also, the employment of the float valve, in connexion with the heater and pipes leading to the boiler, to prevent the accumulation of condensed steam."

43. For an *Improvement in Telegraphs*; Washington A. Peaslee, Indianapolis, Ind.

Claim.—"The mode of dividing a long line of telegraph into two sections, and transmitting signals from either section to the other, viz: by means of two receiving electro-magnets, at an intermediate station, the helices of which are interposed in the line of main wire, one after the other; said magnets acting in conjunction, upon an armature lever, or its equivalent, which, by the motion produced by the attraction of the magnets, makes contact of a ground wire, or wires, with the main line between the two helices, and the said receiving electro-magnets and armature lever being combined with a spring or other equivalent force, adjusted so as to draw back the armature lever, with a force greater than the attraction of either electro-magnet, but less than the sum of their attractions."

44. For an *Improved Sash Fastener*; William Patton, Towanda, Pennsylvania.

Claim.—"The arrangement of the self-acting catch, or holder, with its staples, on the outside of the window frame and sash, so that it can be more easily placed upon any window, without taking it out of the frame, or be readily repaired, and to prevent the cutting away or mortising of the frame or sash."

45. For an *Improvement in the Mutual Arrangement of Vinegar Rooms and White Lead Corroding Chambers*; Robert Rowland, St. Louis, Missouri.

Claim.—"Arranging the room wherein the metallic lead is placed, immediately above the room wherein the manufacture of vinegar is going on, and perforating the floor between the two rooms, so that the acetic acid, which is generated in the manufacturing of vinegar, may pass from the lower room, through said perforations, into the upper room, and there, in combination with carbonic acid produced in the upper room, by the fermentation of wort, or other similar substance, (or introduced into the upper room by pipes,) act upon the metallic lead, for the purpose of converting the metallic lead into the carbonate of lead."

46. For an *Improved Farm Gate*; Smith A. Skinner, Derby, Vermont.

Claim.—"The manner of making the gate, viz: of a series of bars or chains, and upright chains, connected and arranged so as to fold into, and unfold out of, a recess below the sill. Also, the combination and arrangement of the latch bar and the cords, the same being constructed and applied to the windlass."

47. For an *Improvement in Register Bottle Fastenings*; John Smylie, Philadelphia, Pennsylvania.

Claim—"The spindle with its sliding ball, in combination with the arm, projection, lever, spring catch, and dial, or their equivalents."

48. For an *Improvement in Applying Fire Extinguishing Cartridges*; William Mt. Storm, City of New York.

Claim.—"Simply, the plan of projecting into the flames, with precision and penetrating force, by means of an apparatus or gun, purposely adapted, and by means of a projectile power, independently and separately generated, the fire extinguishing gas generating, solid itself, in the concentrated and properly adapted form, and moderate, distinct and rapidly intermittent masses, whereby the gas is generated apart from the machine, and within the source of the fire; by all of which, I attain the many points of increased efficiency and convenience of operation."

49. For an *Improvement in Sewing Machines;* Isaac M. Singer, City of New York.

Claim.—"In combination with the shuttle and attached thereto, the employment of a spring pressure guide, to control the shuttle thread, as the needle enters the cloth or other substance to be sewed. Also, the continuous feed motion, for spacing the stitches, in combination with the vibratory motion of the needle, imparted in one direction by the feed motion, and in the opposite by a spring or any equivalent therefor."

50. For an *Improvement in Sewing Machines;* Isaac M. Singer, City of New York.

Claim.—"1st, The employment of a supporting tongue, placed between and in combination with the two needles, to support the cloth or other substance, and prevent its being puckered during the operation of sewing, and drawing the two rows of stitches tight. 2d, The employment of the guide plates, to guide cloth that has been folded, in making flat or lapped, or other analogous seams, so that the row or rows of stitches shall be made at a regular and determined distance from the folded edge. 3d, The combination, with one or more eye pointed needles and shuttles, or the equivalent therefor, for sewing one or more seams, the employment of a vibrating thread carrier, for carrying a thread or threads alternately in opposite directions, across the seam or seams, and laying it on the face of the cloth, so that it shall be secured to the face of the cloth by the needle thread or threads."

51. For a *Mortising Machine;* Hezekiah B. Smith, Lowell, Massachusetts.

Claim.—"1st, Moving the chisel carriage to and from the wood to be mortised, by power. 2d, In combination, the bent lever, clutches, and pulley stops, or their mechanical equivalent, by which the said chisel carriage will stop its own motion, at or near any desired point."

52. For an *Improvement in Seeding Machines;* H. R. Smith, Massena, New York.

Claim.—"The combination of wheels, with the hopper."

53. For an *Improved Daguerreotype Plate Holder;* David Shive, Philadelphia, Pa.

Claim.—"A daguerreotype plate holder, so constructed, that when its under side is compressed by the hand of the operator, its upper side shall expand, so as to admit of the plate being placed between the hooks thereon, and so that, when the pressure of the hand is relaxed, the said upper side shall contract, causing the hooks to catch upon the outer edges of the plate, and hold it firmly upon the face of the holder."

54. For an *Improved Method of Feeding the Shingle Bolt to Knives;* William J. Scott, Carthage, New York.

Claim.—"The application and construction of the two handled cams. Also, the adjustability of the arms, by means of the bars. 2d, The combination of the rocking lever clutch or hand lever and spring, with the knife frame, for the purpose of feeding intermittingly, the block to the knives."

55. For an *Improvement in Machines for Double Seaming Cans;* Elliot Savage and Noah C. Smith, East Berlin, Connecticut.

Claim.—"The arrangement of the periphery of the bearing roller, that of the roller, the cylindrical portion, shoulder and conical part of the roller. Also, the arrangement and application of two sets of conical rollers, so as to receive and work against the rim of a pan or vessel, and support it."

56. For an *Apparatus for Producing Music by Steam, or Compressed Air;* J. C. Stoddard, Worcester, Massachusetts.

Claim.—"The musical instrument, consisting of a number of what are commonly known as steam whistles, of such tones as to produce a musical scale, arranged in a convenient manner, upon a steam chest, chamber pipe, or generator, and furnished with valves and a rotating studded barrel, finger keys, or other suitable mechanical means of opening the said valves, to allow the escape of steam or air to the whistles. 2d, As a part the said musical instrument, the valve, with its two puppets and seats, of unequal size, and with one end of its stem exposed to the atmosphere."

57. For an *Improvement in Interlocking Grate Bars;* Samuel Vansyckel, Jersey City, New Jersey.

Claim.—"The so casting of grate bars, with projections and recesses on their sides and ends, as that when laid together, they shall interlock, one over, under, or behind the other, in such manner, as to prevent their moving vertically and horizontally, or from warping, whilst they may be readily removed or replaced."

58. For a *Gauge Attachment for Sewing Machines;* George W. Worden, Fayetteville, New York.

Claim.—"The vibrating gauge, formed of the lever with arms attached to its ends, the lever working on a pivot, attached to one of the arms of the sliding gauge, and the arms of the lever working horizontally through the gauge."

59. For an *Improved Card Printing Press;* Daniel K. Winder, Cincinnati, Ohio.

Claim.—"The double inclined bed, traversing form, and inking surface, in combination with the lever, spring roller supports, and operating lever."

60. For a *Leading Clasp for Cattle;* Joseph Welton, Waterbury, Connecticut.

Claim.—"The combination of the spring and slide with the clasp."

61. For an *Improved Method of Operating Farm Gates;* John K. Weber, Seneca Falls, New York.

Claim.—"The arrangement of the levers, cords, in combination with the spring bolt, for opening and closing a gate which opens and shuts both ways."

62. For an *Improvement in Argand Lamps;* John G. Webb, City of New York.

Claim.—"The arrangement of the button and deflector, when used in combination with the draft spaces, on each side of the burner or flame, having the relative proportions set forth."

63. For an *Improvement in Lard Lamps;* J. S. Brown, Washington, D. C., Assignor to John Kent, Baltimore County, Maryland.

Claim.—"The combination and arrangement of the open bowl, with its hollow support, the inverted cup, with its air space and enlarged mouth, and the piston."

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64. For a *Dust Deflector for Windows of Railroad Cars;* James H. Cook, Taunton, Massachusetts.

Claim.—"The rotary deflector, or ventilator."

65. For an *Improved Faucet;* Albert Fuller, Boston, Massachusetts.

Claim.—"The use of the devices employed, for ensuring the accurate sealing of the valve, when actuated by a crank, or other positive motion, the same consisting of the screw rod, traveling in the female screw of the nut or eye, formed on the valve stems, and being cut, and constructed, and arranged, with regard to the screw shaft, so as to operate with the same, whereby the valve, or valve stem, when the plug is drawn upon its seat, are brought into the exact position required for enabling the valve to find its proper seat."

66. For a *Bench-Hook;* A. Hotchkin, Schenevus, New York.

Claim.—"The construction of the bench-hook, viz: having the catch or stop attached by a joint to a plate, said catch or stop being provided with a shank, against which a spiral spring acts, and also provided with a segment bar, having holes in one side, in which a spring pawl catches, and retains the catch or stop in the desired position."

67. For an *Improved Projectile for Ordnance;* Andrew Hotchkiss, Sharon, Conn.

Claim.—"1st, Constructing a shot, or projectile, capable of being fired from a cannon having rifle grooves, said shot consisting of three parts, two of which parts are of hard metal, and the other of some flexible expansive material, in the form of a band or ring, attached to one of the hard metal parts, and overlapping the edge of the other, in such manner, that either by the act of loading or firing, or of both, the said ring shall be so expanded, or distended, that it shall take the impression of the grooves, and be made to fit the bore. 2d, The tail piece, for securing the cap to the body of the shot, and as guide to the cap, on the forward motion."

68. For an *Improvement in Excavators;* Benjamin Hancock, Troy, New York.

Claim.—"1st, The dumping scoop. 2d, In combination with the above, the movable and adjustable frame."

69. For an *Improvement in Vises;* Jasper Johnson, Geneseo, New York.

Claim.—"The combination of lever, swinging lugs, and rack, with one jaw fixed and one movable, in the direction of the rack, to grasp and tighten by one continuous movement of jaw, and admitting of change of capacity without adjustment therefor."

70. For an *Improvement in Wash-Boards;* Joseph Keech, Waterloo, New York.

Claim—"Constructing the operating face of wash-boards, of a laterally depressed and centrally elevated, corrugated surface. for increasing the effective operation of the board."

71. For an *Improvement in Seed Planters;* Ebenezer McCormick, Connellsville, Pa.

Claim.—"So arranging the drag with its link and guides, and the wheels, with regard to a seeding covering apparatus, as that they shall be guides and markers for directing the dropping of the seed at stated intervals."

72. For an *Improvement in Wringers for Clothes;* John McLaughlin, Steubenville, O.

Claim.—"The serrated rotary drum, in combination with the ratchet levers."

73. For an *Impact Water Wheel;* Hiram Morris, Elijah H. Gorton and Edw. Saeger, Crawford County, Pennsylvania.

Claim.—"1st, The buckets so constructed, as to be adjusted and movable; to open and close the issues as may be desired, by means of the circular grooves in the rims of the wheel, and flanches on the buckets, and the studs and bolts passing through the buckets, and fastening the buckets in any desired position, by means of a latch and catch. 2d, A circular concave packing ring, and decking with the adjusting box."

74. For an *Improvement in Churns;* Lewis P. Pease, Mt. Carmel, Illinois.

Claim.—"The winged dasher, formed by two series of carved paddles, rotating around axles projecting outward and slightly upward from a vertical shaft, the said paddles of each series forming a conic frustrum, revolving with its lower edge parallel to the tub bottom."

75. For an *Improvement in Sewing Machines;* Isaac M. Singer, City of New York.

Claim.—"The method of protecting the needle from all injury by the interposition of a movable shield, between the needle and shuttle, which is removed after the needle has descended, to permit the shuttle to pass between the needle and the thread."

76. For an *Improvement in Grain Separators;* Benjamin Wright and John Bean, Hudson, Michigan.

Claim.—"The employment or use of the rotating screws and shoe, whereby the straw is carried through the screens, and the grain shaken therefrom within the screens."

77. For an *Inking Apparatus for Card Printing Presses;* Daniel K. Winder, Cincinnati, Ohio.

Claim.—"1st, The double armed rock shaft, and outward pressing roller frame, or their equivalents, in combination with the platen and the springs, actuating the arm of said rock shaft. 2d, The mechanism for operating the inking roller, combined with the supply roller, actuated by the movement of the platen."

78. For an *Improved Extension Reach for Carriages;* Edwin Wilson, Prattsburg, N. York.

Claim.—"Connecting the reach to the centre piece of the hounds, by means of the cogged bars, slide and clasp."

79. For an *Improvement in Breech Loading Fire-Arms;* H. B. Weaver, South Windham, Connecticut.

Claim.—"1st, Combining the hammer with the laterally swinging chamber, for the purpose of effecting the simultaneous opening of the chamber and cocking of the hammer by means of the lever, the pin, the slide, and lever arm, all operating, whether said slide be a priming slide, or simply employed to connect the chamber with the lever. 2d, Combining the priming slide with the lever and the hammer by means of a pin attached to the lever, working in a slot in the slide, or a link attached thereto, so that the lever will draw back the hammer, before moving the slide far enough to allow the pin, through which the hammer strikes the cap, to move out of the receiving hole in the slide, before the slide is acted upon by the lever."

80. For an *Improvement in Washing Machines;* Charles Love, Peru, Illinois.

Claim.—"The construction within the tube, and above its bottom, of a rack, composed of radial fluted cones, each capable of an independent rotation, and operating for facilitating the washing operation."

81. For an *Improvement in Knitting Machines;* John H. Doolittle, Assignor to the American Hosiery Co., Waterbury, Connecticut.

Claim.—"1st, The method of producing the feed motion, by means of a feed bar, with teeth formed upon it, of proper shape, to engage with, and move or feed the series of needles. 2d, The method of reversing the feed motion, by means of the inclined planes, spring bars, swinging bar, and the cam grooves. 3d, Attaching the blocks or inclined planes to the needles, in such a manner that they will always operate at the end of the course, without reference to the number of needles used. 4th, The method of working the counting apparatus, in combination with the method of throwing the machine out of gear."

82. For an *Improvement in Seed Planters;* Francis G. Wynkoop, Assignor to Henry L. Edson, Corning, New York.

Claim.—"The construction and arrangement of the spades with the tube, when attached to and operated by the slide."

83. For an *Improvement in Casting Tea-Pot Spouts and Handles;* Theodore Ackerman, Assignor to H. H. Homan, William Muhle, and Theodore Ackerman, Cincinnati, Ohio.

Claim.—"The use of an inner non-conducting layer, to the metallic interior surface of the cope or sprue gate of a tea-pot spout mould or analogous object."

MECHANICS, PHYSICS, AND CHEMISTRY.

On the Correction of the Compass in Iron Ships by Magnets.[*]

(Continued from page 198.)

Recently, whilst at Liverpool, I had many, opportunities of testing the views I had previously published on the magnetism of iron ships and its changes; and the results, I am happy to say, were, without a single exception, completely satisfactory and accordant. An example, as beautiful as it was conclusive in respect to the correspondence with theory of the magnetic arrangement in the main body of a large iron ship, will here be in place to be described, not only because of its bearing on the question of this section, but of its affording a sound foundation for the proof of organic changes in a ship's original magnetism.

The ship referred to, constructed of iron up to the main rail of the bulwarks, was yet on the stocks, but ready for launching: burden 1400 tons—head E.N.E. The object of the experiments here was to ascertain how far the ship's magnetic distribution externally accorded with deductions from theoretic principles? A clear idea of the nature of these experiments may, I doubt not, be well conveyed by the help of the annexed diagram of the stern elevation and main breadth section of the actual ship.

[*] From the Lond. Athenæum, Dec. 16, 1854.

In this instance the ship's head being eastward, the polar axis about the main body, theoretically, was expected to run in the direction of the line S N, and the equatorial plane in that of $e\ q$. Various series of experiments were made,—but the concluding series, which was witnessed by Prof. Traill of the Edinburgh University and others, needs only to be described. The object was to determine by means of a good ship's compass, let down from the main rail, and tried at uniform intervals of three inches of depth, where on each side all deviating action from the ship ceased. I had notified to my friends before entering the yard that, according to theory, the difference of elevation of the place of no attraction on the two sides should be 11 feet. At the conclusion of the experiments, it was found by the notes taken by Prof. Traill, that the place of no attraction on the port side was 6 feet 6 inches down, and on the starboard side 18 feet, difference 11 feet 6 inches,—only 6 inches different from the calculation from theory!

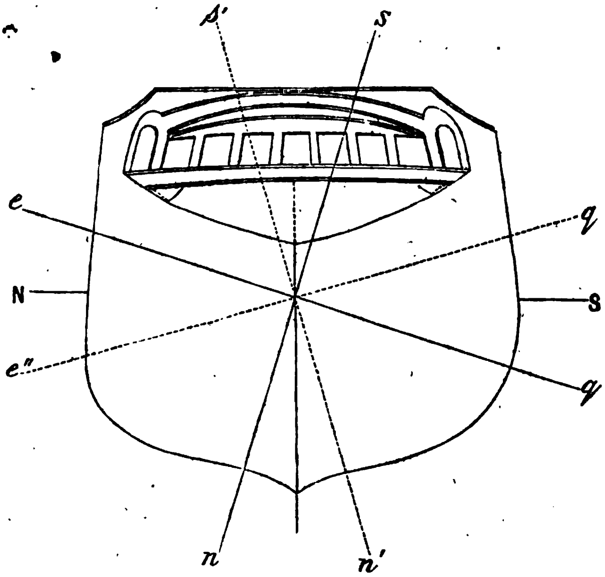
This result was obtained very near the main-breadth section of the ship; but in three or four other positions, separated altogether 64 feet, the variation of the plane on the side that was tried was only a few inches, and the differences quite consistent.

This striking—I may venture to say, beautiful—result, by far the most perfect among the series, because of the condition and position of the ship, will now be employed in the way of proof of the correctness of the opinion I have submitted at the beginning of the section, and of the fact of change, after being launched, in a ship's original magnetic arrangements.

Fortunately for this result, I found another iron ship, the *Imperador*—one of the South American and General Steam Navigation Company's ships of 1740 tons burden—which was just completing her equipments for first putting to sea; and here I obtained the opportunity of making experiments whilst she was being swung for the "adjustment" of her compasses. The *Imperador* had been built with her head lying almost precisely the same as that of the other vessel; and, consequently, her original magnetism must have been very correspondent.

Whilst she was stayed in certain positions for the optician's adjustments, I examined, by the times of oscillation of the needle of a small delicate compass, the places on the two sides, where the needle had its true times of oscillation, and where, of course, the ship had no influence on it. In an *east* direction of the head, where, according to calculation, the difference in elevation of the places of no attraction should originally have been about 12 feet, the actual difference was found to be reduced to *four*. With the head north, the difference appeared to be only about 20 inches. Here, then, we have experimental evidence of a change in the original equatorial plane of the ship of some 8 feet of difference in the two sides,—indicating an angular change in the polar axis of more than 10°. But how had this great, and apparently improbable, change been produced? In the very manner, accidentally adopted, which I had recommended for the modification of extreme magnetic obliquity ['Mag. Invest.' II. 372-5],—by the fixing of the engines and the fitting out of the ship with her head lying *westerly*, or in the opposite direction to that in which she was built.

The great and unusual change which took place in the *Tayleur's* compasses is, if these views be correct, of easy explanation. She had no engines; and her fitting out, there is reason to believe, was unattended with the mechanical violence and particular position favorable for reducing the extreme obliquity of her polar axis. She strained heavily by the gales and seas she met in the Irish Channel. With her head in a westerly direction, her compasses, which originally (before adjustment) had the large deviations of 40° and 60°, changed to an extent of some points. On first reading the evidence on the inquest on the bodies of the unhappy sufferers, I inferred (as already noticed in the *Athenæum* of Oct. 7,) that the ship, then quite new, had been built with her head northerly or easterly; and that the change in the compasses was due to the shifting of the original obliquity of the magnetic polar axis. I mentioned this conviction to a friend at Torquay, who had relations at Liverpool engaged in the building of iron ships, with the view of obtaining, through them, the information I desired. The fact proved exactly as I had anticipated;—the ship was built with her head towards the north-east, and changed her axis of polarity by heaving and rolling with her head the opposite way.



Here a reference to our diagram will show the nature of the change. The *Tayleur's* axis of polarity must have been something near the direction of the line *n s*. In straining and laboring against the sea, with her head westerly, the tendency of the terrestrial magnetism would be to change that axis into the direction of the dotted lines *s' n'*. The reult would doubtless be an intermediate position. The effect under so large a deviation would, of necessity, be proportionate.

The change, then, which took place in the compasses of the *Tayleur* is in such exact agreement with our knowledge of the *principles* engaged in producing it, and the change in a ship's original magnetic lines is an ascertained fact so accordant therewith, that it seems to me that the assumption of such changes being impossible must be utterly untenable. Nor is this conclusion essentially affected by the supposition that some part of the compass errors might be due to the *heeling* position of the ship ; for no reasonable estimation of the effect of heeling could apply as an explanation of these great changes, much less to the fact of the observed difference betwixt two adjusted compasses.

IV. Having thus considered the bearing of certain positions taken in the paper under discussion, and shown, as I am led to suppose, their untenableness,—we are prepared now to consider the real question at issue, *Whether*, as Mr. Airy contends, *the correction of the deviation by permanent magnets is sound and effective*,—*or whether*, according to my convictions, *it is fallacious and dangerous*.

It is to myself a matter of satisfaction to have found, with all our recent experience and enlightenment on the magnetism of iron ships, that the principles of my objections to this process of correction,— as indicated in memoranda made on the paper 'On the Rainbow,' in 1839,—have remained hitherto unshaken. The soundness of the principle of adjustment I had then dissented from, and briefly described in the margin of the paper, "neat, but not safe" ; even "changes of magnetic intensity will produce errors."

But the question here to be discussed is, not whether Mr. Airy's mode of compass adjustment may or may not, in certain cases, be convenient and useful?—for I have constantly expressed the conviction that it may be :— but whether it is not essentially wrong in principle, and so may delude and endanger the navigator confiding in it?

The principle of adjustment by permanent magnets, fixed in contiguity to the compass, evidently goes on the principle that the magnetism mainly to be corrected is, in like manner and degree, permanent. Mr. Airy, indeed, admits that "the magnetism of an iron ship is *slightly* more liable to change than that of a steel magnet very *carefully* preserved ;" but denies that the ship's magnetism is liable to sudden or great changes. The foregoing statements should, I think, go to prove the contrary of this, viz: that in new iron ships, especially, the polar or axial magnetism is exceedingly and essentially liable to change : liable both to great and sudden changes. And this fact is further shown by the general experience and practice of those who are employed in making the adjustments. The first adjustment, are almost always required to be altered. As a general fact, as one of these gentlemen told me, the magnets are required to be *removed further from the compass on subsequent adjustments*, so that the liability to change in new ships is unquestionable ; and so also in ships *not being new*, as in the *Ottawa*, the *Ripon*, &c., sudden changes, sometimes considerable and dangerous, have been known to take place. In passing far into the southern hemisphere, indeed, changes, as matters of experience, are, I believe, all but universal. They are for the most part *great* in the measure of action on the compasses, and, often, on rounding the Cape of Good Hope, *sudden*. In such cases, the adjustments by permanent magnets are found (as I ventured to predict when we had but small actual experience as to the facts) to aggravate the error. To instance a few cases, I may mention those of the East India Company's brig *Fame*, where the errors extended to 57°,—and of the *Three Bells*, of Glasgow, to two points. In the *Royal Shepherd*, the error when near Crozet Island was five and a half points,—in the *Panic*, in 43° S., the error was five points,—in the *Bosphorus* and *Propontis*, as stated in an article in a Plymouth paper, the errors respectively amounted to 30° to 40° and 50° to 60°,—in the *Honey-Moon*, "adjustments were not of the slightest use," &c.

These cases might be vastly extended if all the information I have access to could be used; but in many cases the captains who supplied it objected to its being published without the consent of other parties.

Now, all these cases go obviously to prove that the principle of adjustment must be wrong. An over-compensation appears to be effected, producing an excessive derangement in compasses so adjusted, probably in nine cases out of ten. But if, in certain special cases, compasses so adjusted do act right, as Mr. Airy has shown, what does it prove? A single case of failure, where the correction had been properly made, might strike at the basis of the system; but ten cases of success could not prove its soundness. The compass, in any case, is surrounded by innumerable masses of iron and combinations of ribs and plates, which, to very considerable extent, tend to *compensate* one another's deviating influence; and so, that if a ship could be built with her two sides perfectly and rigidly alike, as to quantity, thickness, hardness, and mechanical action thereon, then we should expect to find a central position,—after the axial obliquity had settled into a medium condition,—where *changes* might go on correspondingly, and the compass, generally, act correctly. Hence, where circumstances approach this condition, the compass in the iron ship may act very well. Cases of this kind are well known. That of the *Great Britain* is a striking instance.

In the case of correctly-acting adjusted compasses, of which Mr. Airy has adduced examples, it remains perfectly uncertain on what quality of the deviating magnetism the adjustment had acted: whether on the inductive or retentive, or on both. Nor is it clear whether the changes in one quality may not have accidentally compensated the changes in the other. The successful cases are no satisfactory set-off against the crowd of failures; but *any one failure* may endanger the navigator who submits himself unsuspectingly to its guidance.

The prevalent failures in adjusted compasses become at once evident against the theory of *permanent* magnetism existing in iron ships, and in favor of the theory of the more enduring quality being *retentive* magnetism,—changeable, under an opposite direction of terrestrial magnetism, by mechanical action; not changeable to a *slight* and unimportant extent, but, as is indicated by its disturbing effects on the adjusted compass, in a very *considerable* degree.

According to the obvious principles of magneto-mechanical action of iron, described in section I., the entire magnetism of a ship would be inverted, if we could upset the ship here, and impress a due quantity of mechanical action on the structure; or, what is the same thing in an *opposite* magnetic latitude, in the southern hemisphere, if such mechanical violence were in ample measure applied. The actual change, then, in the case of a ship sailing or steaming into a southern magnetic latitude will depend on the height of the latitude attained, and the measure and universality of the mechanical violence on the hull of the ship. The vibration or straining may affect the main body, perhaps, both plates and angle irons, and yet, from the singular bracings and defence against special action in the *stem* and *stern-post* and *contiguous angle irons*, may not be able to reach them. In this case, the retentive magnetism of these large and powerfully acting masses of iron might be but in a small measure disturbed, and so leave, for some considerable time, the original polar axis still dominant.

But here experiments are wanting to determine the facts. Such experiments as those I tried on the *Elizabeth Harrison* and *Imperador* (section III.) would soon enable us to arrive at just conclusions, whilst the mere testing of the magnetism of the top-sides of iron ships, of the magnetic intensity of the upper parts of the stem, and stern-post and angle irons, would greatly enhance the appliance for sound and complete theoretic principles. That a ship's magnetism at the Cape, or at Australia, should, therefore, remain positive or negative, the deviation easterly or westerly, or in the same *direction* as when she sailed, in no way invalidates what I have here submitted as being the *tendencies* of principles, but only extends to effects as to their *degree* of elicitation.

In submitting these views as to the unsoundness in the principle of the correcting of compasses by compensating magnets, I feel it due to Mr. Airy, as well also to myself, to say, that it by no means follows that the process may not, for certain circumstances and voyages, be both convenient and useful to the navigator. I have in all cases, where the subject has been thoroughly gone into, expressed the opinion that, with due caution and distrust on the part of the navigator, such adjustment may for a particular compass, be found of considerable convenience. But the applicability here is found to have practical limits—perfectly consistent with theoretic deductions—as regards changes in magnetic latitude.

Mr. Airy, indeed, seems to admit this fact when he says: "For voyages of moderate duration, as, for instance, not further than to the Mediterranean, or to the northern parts of North America, I do not think that any improvement can be made in the existing system." This opinion I am so far from disputing, that, reserving the exceptions of particular changes in the ship's magnetism, I believe it may operate favorably, as shown in "Magnetic Investigations," Vol. II. p. 337, and in the report in the *Athenæum* of October 7, within the limits assigned. And this for satisfactory reasons, as stated in the passages referred to. The dominant compass-disturbing influence in a ship built in this country is the *retentive* magnetism of the *upright* iron. This, whilst in latitudes having considerable northerly dip (as in the case defined), has all the effect of *permanent* magnetism from its being terrestrially sustained,—that is, whilst the earth's inductive force lies mainly in the same direction as that of the ship's principal polarity, mechanical violence can have little tendency to change it.

It is the *horizontal* magnetism here, by far the weakest part, which tends to change; and this no doubt will change by repetitions of mechanical violence under certain changes in the ship's course. From the magnetic latitude of England to that of the Mediterranean, the tendency to change the retentive magnetism of upright iron is extremely small; but beyond the latter, southward, the tendency to change rapidly increases, and in southerly dip must go on with an increasing *tendency to upset* the original polar axis of the ship, as the southerly inclination increases.

V. Here it may not be thought uncourteous, I trust, if I question once more a portion (Sect. II.) of the paper under discussion,—as to *whether objection to the term Retentive Magnetism being given by me to the more fixed part of a ship's polarity, should be maintained on the ground of Mr. Airy's researches on the "Rainbow"?*

Perhaps I do not correctly apprehend the meaning of Sect. II. of the paper; but the points of real importance therein are, I think, sufficiently explicit. To Mr. Airy is most justly due the experimental determination of the fact of the existence in iron ships of *two qualities* of magnetism; and also the elegant application of mathematical talent for the elucidation of their relative influences and properties.

But in regard to the *quality* I have designated as above, I submit the claim for doing so on the ground of having investigated and elucidated that quality, as developed by mechanical action, in the year 1819,—long before iron ships were known. But the question here arises—which is of essential importance in our whole discussion, and therefore should be well considered—whether the more fixed quality of a ship's magnetism be of the kind I refer to, or one characteristically different? Mr. Airy considers it to be "*slightly* more liable to change than that of a steel magnet *very carefully* prepared"; and "to differ very little from the magnetism of hard steel bars." Hence it seems to be implied, that the term by which it was designated almost throughout the paper on the Rainbow—that of Permanent Magnetism—conveys the real characteristic of the quality, as contemplated by Mr. Airy;—an inference plainly pointed to, I think, by the adoption of *permanent* steel magnets as correctives.

That there may here be no misunderstanding as to what I consider the characteristic differences in the several kinds of magnetism, I shall notice, though at the expense of some repetition of the article at p. 1206 of the *Athenæum*, a set of experiments by which I have been in the habit of exhibiting the three qualities of *Inductive*, *Retentive* and *Permanent Magnetism*. For this I take two slips of thin sheet iron and another of elastic steel. The first, I, I free entirely from magnetism: the second, R, I render strongly magnetic by bending, vibrating, or hammering in an upright position: the third, P, I render magnetic by one of the usual processes. Now it will be noted that the differences are most characteristic. Plate I, being held upright near a delicate compass, is found to be indeed magnetic, but to change its polarity if inverted, and if brought near the compass in an east and west horizontal position, to be neutral as at the first. The second plate, R, being held upright near the compass, north pole downward, is found to be powerfully magnetic, and if inverted, though less powerful, it yet retains its original polarity; and being finally brought near the compass in an east and west horizontal position, it exhibits (provided it has not been affected by vibration or bending) the same magnetic energy as the first. But, if whilst being held in a horizontal or an upright reversed position, the plate be now vibrated or bent, the original magnetism will be either neutralized (nearly) or the polarity completely reversed. This quality I have named *retentive* because its polarity is *retained*, whilst no adverse action, mechanically urged, tends to change it. The steel plate, P, will of course have vigorous action on the compass; but its power is found to be *actually permanent*, or at least not capable of being very greatly affected by the most trying employment of mechanical violence. Let it be turned with its north pole upward—a position in which the ordinary retentive magnetism cannot stand a blow or any obvious flexure without change—and then bend it indefinitely often, or strike it in any imaginable manner, and the magnetism, if the steel be good, will undergo but little if any change.

The difference here indicated, therefore, betwixt the magnetism developed in malleable iron and that of good steel bars duly prepared, is most characteristic and conspicuous; the one is controllable by mechanical action under the proper changes of position, the other is not. With the latter, Mr. Airy's compensation clearly accords; but such compensation cannot agree with the changeableness of magnetism developed by the mechanical action of building a ship. And, I may add, if no separate portion taken out of an iron ship can retain its magnetism if hammered in a position opposite to that in which its original polarity was developed, it is not conceivable, I think, that a ship's magnetism, if so treated and under like circumstances, should remain in anything like permanency.

Hence, I apprehend, the denomination of *retentive magnetism* which I have suggested should, if it be not altogether inconsistent with the quality, be conceded to me on the ground, first, of the precedence in date of my original researches; and, secondly, on the ground of the more fixed quality of magnetism in iron ships, as contemplated by Mr. Airy, being essentially and characteristically different from what I have named retentive magnetism. Or, if this latter ground should not be conceded, I would respectfully submit what appears to me to be a dilemma:—That if, on the one hand, the more fixed magnetism be *not permanent*, in nature at least, like that of hard or tempered steel magnets, then the mode of compensation for all regions by such magnets must be scientifically unsound; but if, on the other hand, it *be* permanent in the nature of steel magnets, then no objection, from hence, can lie against my designation of *retentive magnetism* as a quality, which is essentially different.

If these observations on the paper "On the Correction of the Compass in Iron Ships" have extended to an unwonted length, I trust the importance of the subject, both as to commerce and humanity, (where iron as a material has come into such prevalent use in ship-building) will justify the course I have taken in endeavoring to bring the whole case, according to my personal views of it, fairly before the reader. The facts herein given I submit with perfect confidence to Mr. Airy's consideration; the inferences and arguments which I have associated with the facts must apply according to their soundness and deservings.

In conclusion, I have only to add, in respect to any impression my observations here or elsewhere may have made as to the difficulty, if not unsafety, of compass guidance in iron ships,—that my impression has always been, and has constantly been expressed, that such difficulty, or tendency to mislead the navigator, is by no means a *necessity* in regard to ships built of this highly magnetic material. Even now, an immense fleet of iron ships traverse every part of the ocean, and with such measure of comparative safety as serves for their being insured at ordinary premiums. But, whatever may be the practical results at present, as to comparative safety, it would not be difficult, on the plan referred to, to render them *more* safe. The liability to compass changes, which I have pointed out, may, I doubt not, be guarded against, and the evil tendencies prevented by *a standard compass aloft*. This plan I employed myself more than thirty years ago, and have continually urged its adoption for a compass of reference in iron ships. In a letter to the Liverpool Underwriters' Association, I have gone into the details of the plan and the evidences of its general efficacy—evidences derived from many actual cases in which it has been applied, and from a special case in the iron ship *Imperador* referred to in section III. of this paper. Here I had the opportunity of determining the fact, that, where every compass on the saloon deck was subject to an error of from two-and-a-half to three-and-a-half points, a compass raised, in this instance, only thirty-two feet above the deck, was perfectly true on every direction of the ship's head whilst she was swung for the purpose of compass adjustment.

WILLIAM SCORESBY.

Torquay, Dec.

For the Journal of the Franklin Institute.

On Colombian Guano; and certain Peculiarities in the Chemical behavior of "Bone Phosphate of Lime." By CAMPBELL MORFIT, M. D.

This guano was originally introduced into commerce as "*Maracaibo Guano*," and hence is supposed to come from some islands in the Carribean Sea near the coast of that country. Its source, however, is not definitely known, except to those who monopolize the trade in the article.

Its high character as a fertilizing agent, and the discordant results of analyses already on record, having prompted a careful examination of it, I herewith present a report of my research.

As brought, it is in lumps with a compact interior of a chocolate brown color, and a grayish white mammillated exterior resembling an enamel. Between this enamel-looking portion and the compact interior is a lighter brown, porous, stratum. The whole reduces without much difficulty under the pestle, with a dull even fracture, and gives a brownish gray powder.

To insure the complete integrity of the investigation, a large sample of several pounds was procured directly from the State Inspector, and a fair average adjusted by selecting, in equitable proportion, about four ounces from the different phases of the whole mass. The natural form is preferable for analysis, because the powdered article of commerce is liable to admixture with foreign matters which get in accidentally or otherwise during the process of grinding.

The numbers obtained from it are as follows:—

SPECIFIC GRAVITY 2·28.

Accidental moisture,	·500
Constitutional water, expelled at 212° F.,	1·500
" " " " above "	5·100
Organic matter soluble in acid,	1·490
" " " water,	·800
" " insoluble in either acid or water,	·340
Sand and insoluble inorganic matter,	·490
Carbonic acid,	·060
Chloride ammonium,	·090
Soda,	traces.
Magnesia (soluble,)	·010
Phosphate lime (soluble,)	·210
Sulphuric acid,	3·230
Phosphate iron ($Fe_2 O_3$,)	·920
Phosphoric acid,	39·587
Lime,	40·565
Phosphate magnesia,	5·930
	100·822

The accidental water was estimated by drying a given quantity of fine powder in vacuo, over sulphuric acid, and noting the loss of weight. This latter deducted from the further loss sustained by heating the residue over a water bath, until the weight became constant, gave that part of the constitutional water expelled at 212° F. The remaining water of constitution was determined by heating a new quantity of the guano in an atmosphere of carbonic acid, taking the weight of the aqueous distillate which is the totality of water in the guano, and deducting from it the preceding two weights.

To ascertain the gross amount of volatile matter, a given portion was incinerated, and the calx weighed for loss. When at a subsequent stage, the carbonic acid, chloride of ammonium, and organic matters soluble in water and insoluble in acid were severally determined, being a part of the gross volatile matter, they were, together with the combined weight of the three waters, subtracted from it to get the weight of organic matter soluble in acid as expressed by the residue.

A separate quantity of 200 grains was taken for the soluble matters, and digested with sixteen fluid ounces of distilled water, in successive instalments, filtered and washed. The filter was discarded; and the filtrate evaporated over water bath to one-fifth of its volume, after which, it was divided by weight into two equal portions A and B.

From A, the sulphate of lime was precipitated by alcohol, and after 12 hours repose, filtered off and washed with dilute alcohol. Not deeming it expedient to estimate the sulphate of lime in this way, owing to the uncertainty of dissolving out the entire content, even with a large volume of water, the filter was discarded. The filtrate, after evaporation over water bath, to drive off alcohol, was tested with ammonia which threw down the phosphate of lime existing as biphosphate. This being separated by rapid filtration, the filtrate was set aside for 24 hours, at the end of which time crystals of NH_3, HO, $3 MoO$, PhO_5, $12HO$, had formed from the magnesia combined with the phosphoric acid, which was (as will hereafter be shown) retained in the liquid—the normal state of the magnesia having been sulphate.

The soluble organic matter was estimated from B by adding a slight excess of caustic soda-ley to promote elimination of ammonia, and carefully evaporating to dryness in a tarred platinum capsule, over a sand bath, and noting the weight when it became constant; the organic matter having been, then, burned off over the naked fire, the weight was again tested, so as to get the loss which represents its amount.

To separate the ammoniacal salt which, in preliminary qualitative examination, was found to be chloride, but in very minute proportion, I employed a method that yielded only approximate results, but sufficiently exact under existing circumstances.

To avoid any possible loss, by volatilization, in the use of hot water, a fresh quantity of 100 grains of the powdered guano was displaced with cold water, and the solution evaporated over water bath as before, but in this instance, the soda-ley being omitted. When the weight became constant, it was noted; and a red heat afterwards applied and continued until the entire expulsion of both the ammoniacal salt and organic matter. As the loss of weight by this last heating represents these two latter combined, it was only necessary to subtract from it the weight of organic matter previously determined in B to ascertain that of the chloride of ammonium.

For the sulphuric acid and insoluble matters, another 100 grains of the powdered average was digested in pure nitric acid at 212° F., to perfect solution—that which is of uncertain attainment when hydrochloric acid is used, as it acts slowly, and in some instances, imperfectly, and may possibly leave some of the guano undissolved. The solution was diluted and filtered upon a tarred filter, washed with hot water, dried over water bath and in vacuo to get its constant weight, then incinerated, and the calx weighed as sand and insoluble inorganic matter. This latter deducted from the constant weight of the unburned filter, gave the amount of organic matter insoluble in either acid or water.

The sulphuric acid was separated from the filtrate with nitrate of baryta and deduced by calculation from the precipitated sulphate of baryta, which was well washed with nitric acid and hot water previous to being ignited.

Although the filtrate from the sulphate of baryta might be used for the estimation of the remaining components—lime, magnesia, iron, and phosphoric acid—we deemed it advisable to reject it, as the precipitates from so large a quantity of guano as 100 grains would be bulky and not nicely manageable. A new portion of 20 grains was, therefore, substituted and digested in nitric acid and filtered as before. The lime was then precipitated from the filtrate by pure sulphuric acid and alcohol, filtered off after several hours repose, washed with dilute alcohol, ignited and weighed, and the lime deduced by calculation from the sulphate. The entire absence of lime from the filtrate, having been proved by treating a drop with oxalate of ammonia, it was then evaporated over water bath to drive off alcohol, super-neutralized with aqua-ammonia, left at rest 24 hours, for the subsidence jointly of the phosphate of magnesia and phosphate of iron, and filtered. The filtrate having been covered and set aside as C, the filter was displaced with hot acetic acid, which dissolved out the magnesia salt and left the phosphate of iron. This latter was then washed, dried, and ignited; ammonia was in the meantime added to the filtrate, which, after some hours, dropped all the phosphate of magnesia retained in solution by the acetic acid.

From the filtrate c, all the remaining phosphoric acid was separated by a clear solution of sulphate of magnesia and filtration, after 24 hours repose.

The carbonic acid was determined in the usual way, by means of Bunsen's apparatus.

Upon critical examination of the results, it will be observed that the lime, magnesia, phosphoric acid, and water, are in such proportions, that it is impossible to combine them together in accordance with any known formulæ. After minor allotments of lime to the sulphuric and carbonic acids, and the apportionment of the phosphoric acid due to the phosphate of lime to restore it to its original state of bi-sulphate, there is, with that portion to be taken from the phosphate of iron (naturally existing as $Fe_2 O_3$) enough phosphoric acid to convert all the residual lime into bone or tri-basic phosphate ($3 CaO, PhO_5$,) and 7·171 grains to spare.

Now the figures do not allow the hypothesis, that a part of the phosphate of lime, may be neutral phosphate. Nor can any of the lime and phosphoric acid be combined as bi-phosphate in allotropic condition; for though it is true that, bi-phosphate of lime loses its solubility upon being highly heated, yet the physical characters of the guano and the presence of water and organic matter preclude the possibility of its having undergone igneous action. Moreover, it was found that cold water, even in large quantities, would not dissolve out a greater quantity of phosphate, than ·210; still, it must be mentioned, on the other hand, that certain peculiarities of behavior were encountered in preliminary essays. It was observed that the filtrates from the precipitate thrown down in a nitric solution of guano at 212° Fah., by aqua ammoniæ, invariably retained phosphoric acid; and in one instance estimated, to the amount of 4·27 per cent. When the precipitate was in the cold, there was always an accompaniment of lime, but when the nitric solution was boiling, and the precautions recently directed by Denham Smith (*Chem. Gaz.* 1855, p. 203,) were strictly observed, the proportion of lime was reduced to mere traces. On repeating these experiments, with pure bone phosphate and also with bone black, precisely the same result ensued. What relation to quantity may exist between the circumstance of temperature, state of dilution and acidity, is a matter for future experiment and explication. Suffice it to say, that phosphoric acid was always left in solution with the ammonia; and what is also remarkable, the phosphate of lime thrown down from the *hot* nitric solution of guano, always presented, to a limited extent, a most obstinate resistance of the solvent action of acetic acid; thus indicating the formation under the circumstances of an unknown compound, or the assumption of a passive state.

The question then arising as to the original condition of the phosphoric acid retained by the ammonia, an experiment was instituted to determine whether it could possibly have been uncombined. One hundred grains of the guano were boiled in successive portions of distilled water, and the mixed liquids filtered. The filtrate gave an instantaneous acid re-action, and, upon being treated with ammonia and left to repose, dropped both the phosphate of lime and magnesia, there being, not even a trace of lime salt left in solution. When these were filtered off and the filtrate treated with sulphate of magnesia and chloride of ammonium, it yielded upon repose, 2·11 grains phosphate magnesia = 1·35 grains of phosphoric acid. This result having brought to mind the fact of neutral phosphate of magnesia being easily decomposed, by continued boiling with water, into free phosphoric acid and a basic phosphate, (3 MgPh, Os, 7 HO,O,) the portion of phosphoric acid in question was about to be referred to that source; when as a suggestive of the over large quantity and of the above noted peculiarity of magnesian phosphate, the experiments were extended to comprise pure bone phosphate of lime and with nearly analogous results. When boiled with hot water and filtered, the filtrate gave an immediate precipitate, of phosphate lime with ammonia. The same filtrate, after being entirely freed from lime by pure sulphuric acid and alcohol, gave when treated with a mixture of chloride of ammonium and sulphate of magnesia, a considerable quantity of ammonia—magnesian phosphate. A decomposition of the bone phosphate, by the boiling water, was thus evident, but in a different degree from the phosphate of magnesia; for the phosphate of lime in leaving a portion of its acid free, separates partly in a soluble form; whereas, the basic magnesian salt formed under the same circumstances is insoluble.

These facts having indicated the inadmissibility of hot water for the experiment, one hundred grains of the average sample of guano were then leeched with cold water in a displacement tube of one inch diameter and two feet length. The clear liquid running through contained some little bi-phosphate of lime, but only traces of free phosphoric acid.

In conclusion, therefore, it follows from these experiments:

1st, That Colombian guano does not contain either free phosphoric acid, or soluble phosphates, in proportion beyond the ·329 of bi-sulphate of lime.

2d, That as Denham Smith had previously shown (*Chem. Gaz.* 1855,) there are certain precautions requisite, as regards temperature and state of dilution, to insure the entire precipitation of lime by ammonia, from an acid solution of bone phosphate.

3d, That in precipitating phosphates of lime and magnesia with ammonia from an acid solution, under the ordinary circumstances as well as those above mentioned, there is always a variable portion of phosphoric acid left in solution; and therefore, this method so generally followed for the quantitative estimation of the earthy phosphates in guano is inaccurate.

4th, That bone phosphate of lime is partially decomposed by prolonged boiling with hot water into free phosphoric acid and a soluble phosphate of lime.

5th, That the atomic constitution of the earthy phosphates is still an open question, and consequently correct formulæ cannot be constructed from my results.

6th, That the Colombian guano is rich in phosphoric acid and lime; and theoretically, as to these constituents, its money value is far greater than that of bones.

University of Maryland, Baltimore, October 1, 1855.

On the means of Realizing the Advantages of the Air Engine. By William John Macquorn Rankine, Civil Engineer, F. R. SS. Lond. and Edin., &c.*

(Read to the British Association for the Advancement of Science, Section G, at Liverpool, September, 1854.)

(Continued from page 258.)

Section II.—On the Actual Efficiency of Thermo-dynamic Engines: of Steam-Engines in Particular.

12. *Causes of Waste of Heat and Power.*—In considering the waste of heat and power which constitutes the difference between the actual performance and the maximum theoretical performance of engines worked by heat,—as the object now in view is to compare different kinds of engines together, it is not necessary to take into account those causes of loss of power which either are or might be made nearly alike in all kinds of engines, such as the friction of the machinery; those causes alone will be considered which affect the relation between the expenditure of heat and the action of the working elastic substance upon the piston,—in other words, the *indicated* power of the engine; and from these causes will be further excepted the waste of power in forcing the working substance through narrow valve-ports and passages, as this kind of waste arises only from an error in mechanism. As thus restricted, the causes of waste of heat and power may be divided into five classes—*first*, Imperfect communication of heat from the burning fuel to the working substance; *second*, Imperfect abstraction of the heat, which constitutes the *necessary loss* explained in the preceding section; *third*, The communication of heat to or from the working substance at improper periods of the stroke; *fourth*, Any expenditure of heat in elevating the temperature of the working substance; *fifth*, Imperfect arrangement of the series of changes of volume and pressure undergone by the working substance during the stroke. The fourth and fifth causes of waste are often connected with each other.

13. *Application to the Steam Engine.*—In the steam engine the first cause of waste of heat exists when the boiler presents an insufficient surface to the products of combustion, and may be considered to be almost completely removed in tubular boilers of the best construction when properly worked. It is well known that, with such boilers, the consumption of fuel per horse-power per hour is about one-fifth, of what it has in some instances been ascertained to be where boilers of insufficient surface have been employed. The second cause of waste exists where the condensation is imperfect. The third cause of waste, where the cylinder, steam-passages, and boiler are exposed to the loss of heat by conduction and radiation.

As the means of indefinitely diminishing the waste of heat in steam engines from those three causes are already to a great extent practised, it is unnecessary here to refer to them farther.

14. *Action of the Steam in a Perfect Steam Engine.*—To understand the mode of operation of the fourth and fifth causes of waste in the steam engine, let us consider what the action of the steam in a theoretically

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* From the Lond. Philos. Jour., January, 1855.

perfect engine ought to be. We shall commence with the process B of the cycle constituting the stroke, described in article 6. An assigned portion of water being at the required temperature of evaporation, is converted into steam at that temperature, and at a pressure depending on that temperature, by the expenditure of a certain amount of heat, called the *latent heat of evaporation*, which also depends on the temperature. The steam being admitted to the cylinder, propels the piston before it; and when the assigned portion of water has been thus admitted in the form of steam, the communication with the boiler is shut. This completes the process B.

The steam now, without receiving or discharging any heat, expands: during this expansion its temperature falls by the conversion of heat into mechanical power; the pressure, of course, diminishes at the same time: this expansion ceases when the pressure and temperature of the steam have fallen to the degree fixed for its condensation. This completes the process C. During the process D, the piston returns, and a portion of the steam is liquefied by contact with some cold conducting substance, which abstracts the heat generated by its liquefaction, so as to maintain it at the fixed temperature and pressure. The process D ought to stop in time to leave a portion of uncondensed steam sufficient for the process A, now about to be described. The water and steam being now prevented from receiving and discharging heat by conduction, the piston continues its return stroke, and forcibly compresses the remaining portion of steam into the liquid state. This constitutes the process A; and the portion of steam so condensed ought to be just sufficient, by the heat generated by its liquefaction, to elevate its own temperature, as well as that of the water previously liquefied, to the original temperature of evaporation, so that the entire portion of the water employed may be in every respect in the same condition as it was at the beginning of the cycle of processes B, C, D, A, which may be repeated *ad infinitum*. Such an engine would fulfil the conditions of maximum theoretical efficiency; for the elevation of the temperature of the water would be effected without expenditure of heat, and the only heat expended would be the latent heat of evaporation: those results being produced by the proper arrangement of the changes of volume and pressure undergone by the working substance during each stroke.

15. *Impracticability of such a perfect Steam Engine.*—It is impossible to fulfil wholly in practice the conditions prescribed in the preceding article. To show the nature of the obstacles, let us begin with the process A. The forcible compression of a certain proportion of the steam into the liquid state, would not only cause a very inconvenient degree of inequality in the action upon the piston at different periods of the stroke, but it is difficult to conceive any mechanism by which it could be effected in practice. The steam must therefore be wholly liquefied during the process D, and the temperature of the feed-water must be raised from the point of condensation to that of evaporation by expenditure of heat. A certain amount of heat is thus wasted; at the same time the power which would have been expended in compressing the steam is partly saved; but the saving of power bears a small proportion to the mechanical equivalent of the heat wasted.

The amount of waste thus occasioned is comparatively unimportant in practice, provided it be not increased by unskilful methods of heating the feed-water; for, under ordinary circumstances, the heat required for that purpose seldom exceeds one-seventh part of the latent heat of evaporation, and it may be considered to reduce the efficiency of the engine below the theoretical maximum by about one-sixteenth.

Another and more important point in which the conditions prescribed by theory cannot be exactly fulfilled, is the extent of the expansion during the process C: if this expansion were carried in practice down to the pressure of condensation, the cylinder and every part of the engine would be bulky, heavy, and costly, and the action of the steam upon the piston, during the latter portion of the stroke, would be so feeble as to cause an unsteadiness of motion unsuitable for the driving of machinery. The expansion, therefore, cannot be fully carried out. The diminution of efficiency from this cause depends upon the extent to which the expansive working is carried. Should the expansive working be wholly omitted, the efficiency may be reduced to one-third or one-fourth of its theoretical value, or even less, according to circumstances.

16. *Actual Efficiency of well-constructed Steam Engines.*—In single-acting engines for pumping water, in which the difficulties of employing a great extent of expansive working are the least, the actual efficiency has already, in some cases, attained a value nearly approximating to its maximum theoretical value. In double-acting engines, however, so long a range of expansive working cannot be employed; and their ordinary average consumption of coal, when skilfully made and worked, is four pounds per horse-power per hour, the coal being of the evaporating power already specified. This corresponds to an efficiency represented by 0·0825, being about 0·46 of the theoretical maximum.

Considering that the causes of waste of heat and power in the steam engine are, as has been already explained, incapable of being wholly removed in practice, it may be estimated that the greatest amount of actual efficiency to be expected in double-acting steam engines by any probable improvement, is about three-fourths of the theoretical maximum, or 0·133,—corresponding to a consumption of coal, calculated as before, of 2½ lbs. per horse-power per hour.

SUPPLEMENT TO SECTION II.—*On the Steam and Ether Engine of M. du Trembley.*

(16 A.) This engine exemplifies one means of diminishing that difficulty attending the fulfilment of the conditions of theoretical perfection in the steam engine, which arises from the impracticability of expanding the steam until its pressure has fallen to that corresponding to a low temperature of condensation.

Instead of carrying the expansion of the steam to the great extent required by theory, it is carried to such an extent only as is convenient in practice. The steam is then liquefied at the pressure attained at the end of its expansion, and the heat given out during its liquefaction is employed to evaporate ether, which works an auxiliary engine. By this process, after the expansion of the steam has been carried to a certain extent, *vapor of ether* is in fact *substituted for the steam* and made to perform the remainder of its work in its stead; and as the vapor of ether, at a given temperature, exerts a higher pressure and occupies a less volume than steam does, the cylinder of the auxiliary ether engine occupies much less space, and gives a more steady action than would be required for the performance of the same work by continuing the expansion of the steam.

The maximum theoretical efficiency of the steam and ether engine is the same with that of any other thermo-dynamic engine working between the temperature of evaporation of the water, and that of liquefaction of the ether.

Its advantage consists in obtaining a nearer approximation to that theoretical efficiency within given limits as to the bulk and cost of the engine, than is practicable with an engine worked by steam alone.

SECTION III.—ON THE ACTUAL EFFICIENCY OF AIR ENGINES.

17. As the object of this paper, in referring to the actual performance of previous air engines, is to illustrate the waste by which that performance falls short of the theoretical maximum, I shall refer to those engines only which have actually been at work, and the details of whose performance have been made public with tolerable precision, namely, the engine of the Messrs Stirling, and that of Captain Ericsson, which latter was used for marine propulsion about the year 1852.

18. *Stirling's Air Engine.*—In describing generally the air engine which was invented by the Rev. Robert Stirling in the year 1816, and improved by him and Mr. James Stirling at subsequent periods, it will be sufficient to speak as of a single-acting engine only; a double-acting engine having simply a similar apparatus for each side of the piston.

Suppose a cylindrical cast-iron air-receiver, of sufficient strength to be safe with a working pressure of sixteen atmospheres, with a convex hemispherical bottom, and a concave hemispherical top, to be placed in a vertical position over a flue connected with a furnace, but screened from the radiant heat; the hemispherical bottom of this receiver constitutes the surface for the reception of heat; I believe it was 3 inches thick in the engine last erected. Within this vertical receiver there is a hollow metal plunger, filled with some non-conducting substance, and capable of being moved up and down by means of a rod. This plunger is of precisely the same form with the receiver, but considerably less in height, and somewhat less in diameter. The effect of raising this plunger is to displace the air from the upper part of the receiver, and to send it down to the bottom, where it is exposed to heat; the air passing through the space between the plunger and the sides of the receiver: the effect of lowering the plunger is to cause the air to return to the top of the receiver. In the interior of the uppermost part of the receiver is a coil of small tubes, in which cold water is made to circulate, and amongst which the air must pass whenever it is displaced. Lower down, and occupying the annular space between the plunger and the receiver, are a number of parallel vertical plates of metal or glass, with narrow interstices between them, through which the air must pass on its way up or down. This system of plates is called the *Economizer* or *Regenerator;* its object being one which has already been explained in article 8, namely to store up the heat given out by the air during process C, when its temperature is being lowered, and to give back the same heat to the air during process A, so as to raise its temperature. Lower still, the receiver has an internal false bottom, pierced with many small holes, through which also the air must pass, and whose effect is to bring every part of the air into close contact with the heated iron bottom of the receiver. Suppose, further, that this receiver communicates at its top, through a sufficiently wide passage or nozzle, with the lower end of a working cylinder containing the piston; the receiver and cylinder are, in the first place, filled with compressed air, of any required density, by means of a small forcing-pump. As the same mass of air is used over and over again, this pump has to be subsequently worked to no further extent than is necessary to supply the loss of air by leakage, which has always been found to be extremely small. A pump is also required to keep up a stream of cold water through the coil of tubes before mentioned.

19. *Mode of operation of Stirling's Air Engine.*—Suppose the piston to be at the bottom of the cylinder, and the plunger at the bottom of the receiver, the mass of air in the receiver is now at the top amongst and near the cold-water tubes, and its temperature is low. Let the plunger now be partially raised, part of the air is forced down through the economizer into the space between the outer and inner bottoms of the receiver, and through the holes of the inner bottom, into the space below the plunger. In passing over the heated bottom of the receiver, it has, in the first place, its temperature raised by the reception of heat from the furnace. At this point the cycle of processes formerly described may be held to begin.

Process B.—The air below the plunger receives an additional supply of heat from the furnace, which disappears in expanding it. The air below the plunger, in the act of expanding, lifts up the plunger and the mass of air above it, which latter mass of air, passing through the nozzle, lifts the piston.

Process C.—The plunger descends and forces the air below it through the holes of the inner bottom, and through the metal or glass plates of the economizer, which absorb, more or less completely, the sensible heat of the air. This air, by passing amongst the cold-water tubes, enters the space above the plunger. Should it leave the economizer at a temperature higher than that of the cold-water tubes, the latter abstract an additional portion of its sensible heat.

Process D.—The piston descends, compressing the whole mass of air; the heat so generated is abstracted by the cold-water tubes.

Process A.—The plunger partially rises, as before; a portion of air descends through the economizer, and recovers the heat remaining stored up there. Should its temperature, on leaving the economizer, not have attained its original elevation, the additional sensible heat required is supplied from the furnace through the bottom of the receiver.

The cycle of processes is now finished, and may be repeated *ad infinitum*.

Thus, it appears, that the air confined in the receiver and cylinder of Stirling's air engine consists of two portions: one portion, which always remains above the plunger, and which serves merely as a perfectly elastic cushion, to transmit pressure and motion between the piston and the other portion of the air, and not as a means of developing power; and another portion of air, which, being driven by the plunger to the bottom and top of the receiver alternately, is successively heated, expanded, cooled, and compressed; and, as the expansion takes place at a high temperature, and the compression at a low one, more power is produced by the former than is consumed by the latter, and thus there remains a surplus of available power for the engine.* The existence of the cushion of air before mentioned, leads to an important practical advantage; for it is this air alone which comes into contact with the cylinder, the piston, the packings of the piston, and those of the plunger-rod, which are consequently never exposed to a high temperature.

It was, perhaps, mainly in consequence of this, that Stirling's engine, with its final improvements, required less oil and fewer repairs, worked with less friction, and was less liable to get out of order, when properly managed, than any steam engine.

Stirling's air engine employed to drive the machinery of the Dundee Foundry, was double-acting, having two receivers, one connected with the top and the other with the bottom of the cylinder. The plungers of those receivers were suspended by their rods from the opposite ends of a small beam. A reciprocating motion was given to that beam by means of a piece of mechanism which possessed a power of regulating the length of stroke of the plungers; and in its effect, though not in its construction, was analogous to the link motion.

The testimony of Mr. James Stirling to the advantages of this engine, was corroborated by that of the late Mr. Smith of Deanston, and by that of Mr. James Leslie.

20. *Efficiency of Stirling's Air Engine.*—According to Mr. Stirling, the air in his engine received heat at the temperature of 650° Fahr., and discharged the lost heat at that of 150° Fahr. The fourth example of the table in Article 10, shows that the efficiency of a theoretically perfect engine, with those limits of temperature, would be 0.45, and its consumption of coal 0·73 of a lb. per horse-power per hour.

It appears that the actual consumption of coal per horse-power per hour was about 2·2 lbs., being three times the consumption of a theoretically perfect engine, and corresponding to an actual efficiency of 0·15, or one-third of the maximum theoretical efficiency.

Stirling's air engine, therefore, was more economical than any existing double-acting steam engine,—probably indeed more economical than any possible double-acting steam engine. As compared, however, with a theoretically perfect engine, working between the same temperatures, it appears that two-thirds of its expenditure of heat was wasted.

21. *Causes of waste in Stirling's Air Engine.*—We shall now investigate the causes of waste in Stirling's air engine, according to the classification explained in article 12.

(1.) *Imperfect communication of heat from the burning fuel to the work-*

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* In calculating the space to be traversed by the piston of an air engine, in which part of the air acts as a cushion, allowance must be made for the space through which this *cushion air* expands and contracts, with the variation of pressure, as well as for the space required for the changes of volume of the *working air*. The total space traversed is thus increased in a certain proportion, and the mean effective pressure diminished in the same proportion; so that the mechanical effect remains unaltered.

ing substance.—As the heating surface in Stirling's air engine consisted simply of the hemispherical bottoms of the receivers, it was of the worst form possible for exposing a large surface within a given space. A steam boiler of that form would occasion an enormous waste of fuel; it is probable, therefore, that this first cause of waste operated powerfully in Stirling's engine.

(2.) *Imperfect abstraction of the lost heat.*—It is probable that Stirling's engine was comparatively free from this cause of waste, for the cold water tubes exposed a large surface, and were abundantly supplied with water.

(3.) *The communication of heat to or from the working substance at improper periods of the stroke.*—This cause must have operated powerfully to occasion waste of heat in Stirling's engine, for the following reason: It is obvious, from the construction of the engine, that the air, whether being expanded or compressed, must have been continually circulating over the heated bottom of the receiver, and receiving heat through it from the furnace, at all periods of the stroke. Now it is only while the air is being expanded that the heat received by it is effective in producing power; while the air is being compressed, the heat received by it is detrimental. The heat received, therefore, by the air in Stirling's engine during at least one-half of each stroke—that is to say, probably one-half of the heat received—must have been absolutely wasted: it would be simply carried to the cold water tubes, and there abstracted, without producing any work. It is probable that, in an air engine free from such cause of waste of heat, a much smaller extent of cooling surface would be found sufficient to abstract the lost heat.

(4.) *Expenditure of heat in elevating the temperature of the working substance.*—In the air engine, the sensible heat of temperature is not, as it is in the steam engine, of secondary importance. If the temperature of the air in an air engine were elevated together by means of heat supplied from the furnace, the waste from this cause would be from three to four times greater than the latent heat of expansion which performs the work, and the economy of the engine would be entirely destroyed. Some persons, founding their calculations upon this supposition, have pronounced the air engine to be necessarily wasteful and inefficient.

The sensible heat in question might be entirely produced by an additional compression of the air performed during the process A, the power employed to effect such compression being developed by an additional expansion performed during the process C, in which the temperature of the air falls. To afford room, however, for the additional expansion, the bulk of the engine would have to be increased about five-fold, which would render it inconvenient in practice, especially for propelling ships.

The process actually pursued in Stirling's engine, of storing up the sensible heat by means of the economizer or regenerator, and using it over and over again, has already been generally described. In the original engine of the Rev. Robert Stirling, the regenerator consisted simply of the sides of the receiver and plunger, the latter being covered with a network of wires, in order to increase the surface; in the engine, as improved by Mr. James Stirling, it is composed of thin parallel plates of metal or glass. In Captain Ericsson's engine it consists of several sheets of wire gauze.

The efficacy of a regenerator to prevent expenditure of heat in raising the temperature of the air increases with its mass and surface; but no amount of mass and surface, how large soever, is sufficient to make it act with theoretical perfection. There is reason to believe, however, that both in Stirling's and in Ericsson's engines the masses and surfaces of the regenerators were sufficient to reduce the waste of heat, in raising the temperature of the air, to a very small quantity.

Some persons, overlooking the latent heat of expansion—the real source of power—appear at one time to have imagined that a theoretically perfect regenerator would prevent all expenditure of heat whatsoever, except losses by conduction and radiation. This amounted to representing Stirling's air engine as a machine for creating power out of nothing, popularly called a "*perpetual motion.*" It is very probable that the promulgation of that erroneous theory may have led scientific and practical men to regard the real performances of this engine as delusive, and may have been the cause which, notwithstanding its economy as compared with steam engines, prevented the extension of its use beyond the Dundee Foundry.

(5.) *Imperfect arrangement of the series of changes of volume and pressure.*—It is not likely that in Stirling's engine any material amount of waste arose from this cause, for the series of changes in question would be regulated by the relative motions of the piston and plungers; and those motions being susceptible of adjustment, as in the case of the piston and slide-valve of a steam engine, would be fixed, by trial, so as to act in the manner found to be most advantageous.

From all that has been stated, it appears,—that the principal causes of waste of heat in Stirling's engine were—first, deficiency of heating surface; and, secondly, communication of heat to the air during that part of the stroke when it was not being expanded;—that the latter cause was sufficient of itself to double, or nearly to double, the theoretical consumption of fuel; that the actual consumption of fuel was triple the theoretical consumption; but that, notwithstanding such defects, the engine was economical as compared with steam engines.

22. *Ericsson's Engine of* 1852.—In this engine the compression and expansion of the air were performed in two different cylinders, and at each stroke the air which had been used was expelled into the atmosphere, a fresh supply of air being at the same time taken in to perform the next stroke. This process of expelling the used air, and taking in fresh air, corresponded to the process C of the cycle; for the air expelled being, while in the cylinder, at a high temperature, was driven through a regenerator of wire gauze, and there left its sensible heat. This mode of working involved a great practical disadvantage, especially for marine purposes; for the cylinders had to be made large enough to contain the requisite supply of air at the ordinary atmospheric pressure, and the engine was consequently of enormous bulk and weight as compared with its power.

To proceed to the process D: It consisted in compressing the air with which the compressing cylinder had been filled to about two-thirds of its original volume, and forcing it into a receiver or magazine for compressed air. There was no provision in the compressing cylinder for abstracting the heat produced by the compression, and a certain waste of power must have arisen from this cause, which will be again referred to in its order.

The process A, consisted in opening the induction-valve of the expanding cylinder, and filling that cylinder about two-thirds full of the compressed air. In the act of entering the expanding cylinder, the air passed through the regenerator which was fixed in the nozzle, and receiving the heat stored up there, had its temperature elevated. On the admission of the proper quantity of air, the induction-valve was closed.

The process B, consisted in the expansion of the air in the expanding cylinder, the latent heat being supplied from a furnace placed directly beneath the bottom of that cylinder.

The process C, was then recommenced by opening the eduction-valve, to allow the hot air to escape through the regenerator, and so on, as before.

23. *Efficiency of Ericsson's Engine of* 1852.—In calculating the efficiency of this engine, I have been guided chiefly by data contained in the report of Professor Norton (regarding him as a neutral inquirer). As nearly as I can judge, the efficiency of a theoretically perfect engine, working between the same temperatures, would be 0·404, corresponding to a consumption of 0·82 lb. of coal per horse-power per hour. According to Professor Norton, the actual consumption was 1·87 lb. of *anthracite*, being equivalent to 2·8 of bituminous coal, if 3 lbs. of bituminous coal of the quality specified in this paper be taken as equivalent to 2 lbs. of anthracite. This is about 3·4 times the consumption of a theoretically perfect engine, and corresponds to an actual efficiency of 0·118, being less than the maximum theoretical efficiency in the ratio of 0·295 to 1. The waste of heat and power, therefore, in Ericsson's engine must have been very great, though it was economical of fuel as compared with steam engines.

24. *Causes of waste of heat in Ericsson's Engine of* 1852.—(1.) *Imperfect communication of heat from the furnace to the air.*—This cause of waste of heat must have operated to a great extent in the engine in question; for the heating surface was simply the bottom of the expanding cylinder; at the same time an extensive heating surface was rendered doubly necessary by the low pressure of the air; for, as was long since shown by Dulong and Petit, the power of gases to receive and communicate heat increases with their pressure.

(2.) *Imperfect abstraction of the lost heat.*—It has already been stated that there was no provision for abstracting the heat produced in the compressing cylinder; the direct effect of this would be to cause an additional and unnecessary expenditure of power in compressing the air.

(3.) *Communication of heat to the air at improper periods of the stroke.*—This cause of waste must have operated to a considerable extent; for the air, after having performed its work, and while in the act of being discharged into the atmosphere, continued to circulate over the heated bottom of the cylinder, and must have carried away a considerable amount of heat. This heat would not be stored in the regenerator, which must have received no more heat from the escaping air than had been previously abstracted from it by the air when entering, or otherwise the temperature of the regenerator would have gone on continually rising.

(4.) *Expenditure of heat in raising the temperature of the air.*—There is reason to believe that in Ericsson's engine, as in Stirling's, the regenerator was adequate to prevent any considerable waste from this cause.

(5.) *Improper arrangement of the changes of volume and pressure.*—There is no reason to believe that any material waste arose from this cause.

It may be observed that Ericsson's engine, as well as Stirling's, was absurdly represented by some parties as a "*perpetual motion.*"

(To be Continued.)

For the Journal of the Franklin Institute.

Mechanical Engineering as applied to Farm Implements. By H. Howson, Civ. Eng.

It has been repeatedly and truly remarked, that no branch of mechanical engineering has been so much neglected as that relating to the manufacture of implements for farm purposes. But comparatively few years have elapsed since the only instruments used in tilling the soil, gathering crops, and other indispensable requisites attending agricultural pursuits, were those of the most simple and primitive forms; instruments, such as we have every reason to believe were used by the ancients and handed down from father to son, without any material alteration of form, and with but trifling improvements as regards general utility.

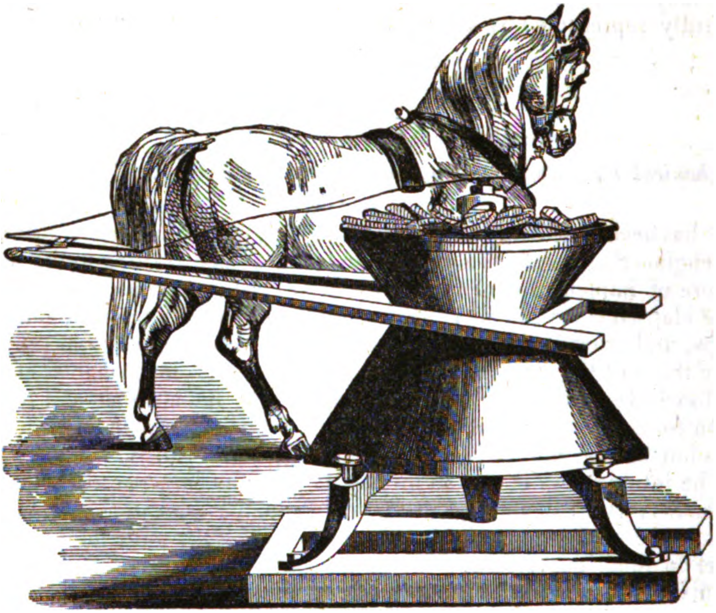
The introduction of the steam engine gave an impetus to mechanical ingenuity, which developed itself with a rapidity unexampled in the history of the world. Gigantic projects and wonderful results followed each other in quick succession. Steam navigation had ceased to be looked upon with admiration and astonishment, railways had become an actual necessity. A revolution had taken place in the manufacture of almost every article necessary for man's requirements. Implements of war even had been improved upon and rendered more ingeniously deadly, and yet the farmer plodded on in his old fashioned style, loth to believe that his time-honored implements could be advantageously altered or improved upon. We may attribute this neglect to two sources: first, the mistaken but pardonable vanity of inventors, who expended their ingenuity on subjects from which more extensive and profitable results were likely to follow than that of scheming agricultural machinery; secondly, the still more mistaken and less pardonable obstinacy of the farmers themselves, who continued to adhere with a dogged pertinacity to a class of implements far behind the age.

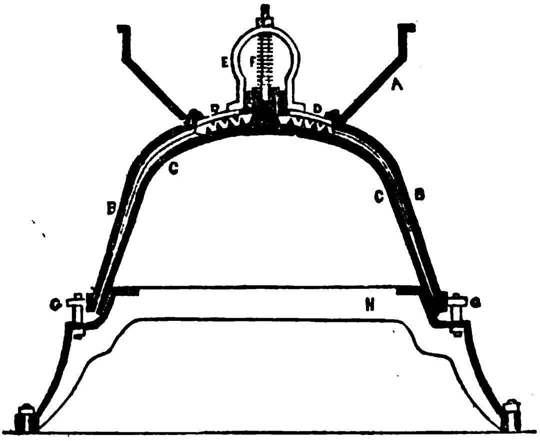
A new class of farmers, however, began gradually to appear. Men of education and perception, who were willing to look upon agriculture not as a defined and unalterable process of labor, but chemically, as well as mechanically, a science, offering inducements to the industry and talents of the ingenious, which have been developed in the production of a class of implements endless in variety, and inestimable as regards utility.

Machinists engaged in the construction of fine and elaborate works, are too apt to suppose that but little circumspection is required in designing machinery for farm purposes. This is a great mistake, however, for if minute exactitude is not absolutely necessary, lightness, cheapness, durability, and efficiency, are the unavoidable requirements in producing that class of implements. The annexed engravings of

A Corn and Cob Mill, Patented by R. D. Granger, Esq.

In September last, will afford a good example of the careful manner in which the four above mentioned elementary requisites have been brought





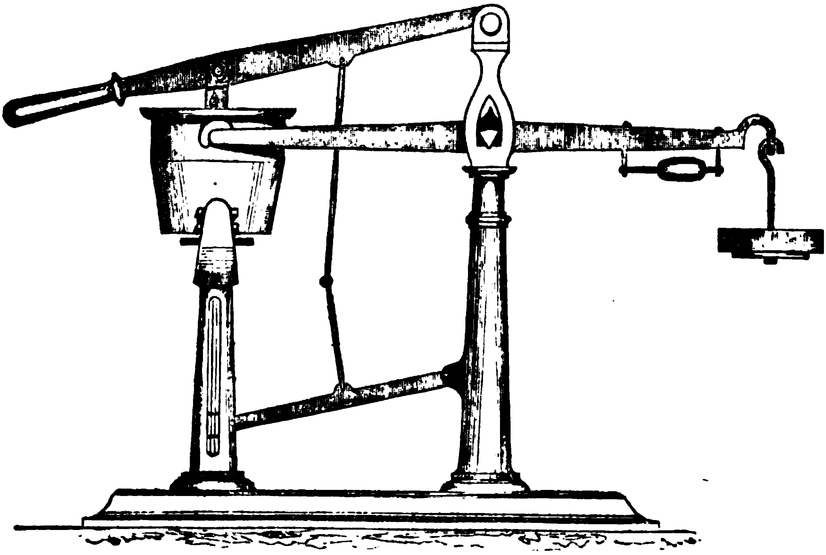
to bear on a class of machines which, although but recently brought into general use, have now become indispensable to all the best appointed farm yards of this country.

On reference to the sectional view, A, is the hopper secured to the outside shell B, the upper rounded portion of which, is connected to a central hub by four or more arms D. C, is the stationary burr, having on the top a spindle fitting easily in, and projecting through the central hub. In the top of the spindle is cast a screw, the upper end of which passes through the top of the arched piece E, the latter being secured to the arms D. A spiral spring F, surrounding the screw, intervenes between the top of the spindle and underside of the arched piece. H, is a cast iron ring fitting accurately to the inside of the stationary burr, and to this ring are cast or otherwise secured, the legs of the machine. To the projecting portions of these legs, are secured pins on which run loose the horizontal rollars, G, the peripheries of which bearing against the belt cast on the lower edge of the outside shell, serve to keep the latter, as it revolves, central with the stationary burr C. From the underside of the arms D, and on the arched top of the stationary burr project detached pointed teeth, those on the arms passing between the spaces formed by those on the burr. From the point where the arms D join the outside shell, to the point where the rounded portion of the same meets the straight sides, are coarse sharp edged teeth, and the same on the burr, arranged in straight lines on the latter, but diagonally on the former. The remaining portions of the shell and burr are furnished with similar teeth, coarse towards the top and finer near the bottom. A triangular shaped wooden frame shown in the perspective sketch, is secured to projections cast on the outside shell, and serves as a lever for turning the same. The corn and cob together is thrown into the hopper A, which is caused to revolve together with the outside shell B, and passing between the arms D, is acted upon by the teeth projecting from the same and those on the top of the burr; the material then passes to the coarse teeth on the rounded portion of the shell and burr, where it becomes sufficiently triturated to pass to the finer teeth, which further levigate the material, before it passes out at the bottom. The spiral spring F, has a tendency to keep the outside shell from too close contact with the stationary burr, the distance between each being regulated by the nut on the top of the arched piece E, so that the mill may be arranged to grind fine or coarse at pleasure. The efficiency of this mill is no doubt owing to the peculiar arrangement of breaking and grinding teeth, those on the rounded portion of the shell and burr acting on the kernel with a triturating effect, which rapidly breaks them into pieces of sufficient minuteness to be acted upon by the finer teeth below. The whole machine is light and easily removed from place to place, and the castings are made with such accuracy, that after the sand is removed from their surfaces, they can be fitted together at once without the use of files or drills. Although capable of grinding from ten to fourteen bushels of feed per hour, the mill, complete for operation, can be retailed at the low price of $30.

Among farm operations, such as appertain to the dairy have not been overlooked by inventors. Churns, especially, have received more than ordinary attention at their hands. At one time the struggle for supremacy in this class of implements had arrived at such a feverish pitch that the earnest competition has been termed the American churn mania. Some 250 patents for churns have been granted by the United States office up to the present time, from which it would appear that something approaching to perfection must have ere this been arrived at, in the designs of these valuable instruments. After the cream had been rapidly and effectually converted into butter, some labor saving process of forming the same into blocks of accurate weight for the market had yet to be contrived.

Reinert's Apparatus for Weighing and Stamping Butter.

For effecting this purpose a simple and ingenious machine was invented and patented by W. S. Reinert, in May, 1854, a side view of which is represented in the annexed engraving. A beam somewhat similar to that of an ordinary pair of scales, is supported on a column secured to a base plate. On one end of this beam is the weight and an apparatus for adjusting the same. The other end is forked so as to embrace the cup or mould for receiving the butter, the cup having lugs on the side which rest on the ends of the fork. On each side and towards the bottom of the cup, are two other lugs, between which are projections from the forked ends of a second column. The latter is hollow for receiving a vertical spindle, on the top of which is a disk, the bottom being connected to a lever which has its fulcrum on the main column. Immediately above the centre of the beam, and on the top of a continuation of the main column, is the swivel joint of the stamping lever, which is arranged to turn laterally at pleasure. The end of the lever is furnished with a handle for the operator, and immediately above the cup with a jointed rod having on its end a disk, to which is secured the wooden stamp carved with the device required. The stamping and lower levers are connected together by means of a light chain or jointed rod, and the cup is furnished with a false bottom, which, together with the inside of the cup, is enamelled. The stamping lever with its disk removed from the cup is, by means of the swivel joint, removed on one side, and the butter placed in the cup, to the requisite amount indicated by the sinking of the same, as far as the lugs and projections on the forked column will allow. The stamping lever



is now turned until the disk coincides with the cup, and is then brought down, so that the disk may stamp and compress the butter, which assumes a form similar to that of the cup. The lever is now raised nearly perpendicular, giving through the connecting chain a movement to the lower lever, which raises the perpendicular rod in the column, and causes its disk to elevate the false bottom, and with it the butter above the top of the cup, from whence it may be easily removed. The machine is now ready for a second operation. It will be easily seen with what rapidity butter may be weighed and branded, at one operation, by the use of this neat apparatus.

(To be Continued.)

THE CAMDEN AND AMBOY RAILROAD ACCIDENT.

Report of the Executive Committee to the Joint Board of Directors of the Delaware and Raritan Canal and the Camden and Amboy Railroad and Transportation Companies.

BORDENTOWN, SEPTEMBER 10, 1855.

GENTLEMEN:—On the morning of the 29th of August, the ten o'clock train from Philadelphia for New York, left, as usual, the depot at Camden, in charge of Isaac Van Nostrand, one of the most experienced and best conductors in the employ of the Railroad Company. Mr. Van Horn, the agent of the company, whose duty it is to see that all is right before the train starts from Camden, examined the bell-rope of the ten o'clock train on the morning of the 29th of August, a short time previous to its departure from Camden, and found it right.

The train immediately thereafter proceeded to Burlington, where it arrived safely and in time. The 8 o'clock train from New York, which was then due at Burlington, had not made its appearance, having arrived at New Brunswick behind time. The regulation time of the Philadelphia train at Burlington having expired, and the conductor having ascertained by telegraph, that the New York train had left Bordentown at 10·56 o'clock, he proceeded with the ten o'clock train, as he had done on all previous similar occasions, under the assurance that there was no hazard of collision, because the track was for the most part level and straight, and both trains were known by their respective conductors to be on the track and approaching each other.

There was no collision.

The result proved that the regulation of the Company was a salutary one, enabling the couductor to expedite his train without the least danger of collision.

As anticipated, the trains came in sight of each other where the track was straight, and, as usual, they both halted; and the Philadelphia train, blowing its whistle, commenced backing at about the rate of fifteen miles per hour, for the nearest turn-out; whilst all the employees of the train were keeping a vigilant look-out for obstructions on the road, and attending to the brakes.

The whistle was repeatedly blown, and the employees steadily engaged watching the track, on which cows had been seen as the train was passing up, until the cross-road where the collision took place was reached; when of a sudden a pair of horses attached to a carriage, were driven at the rate of eight or ten miles an hour on the track, so near the train, as to render it impossible to check its speed, or in any way to prevent the melancholy collision, the fatal results of which are already known to you. From the outside line of the railroad to the car which struck the horses, is twenty-nine feet, which, at the speed of ten miles an hour, would require less than two seconds to pass. How impossible, therefore, is it to devise means for the protection of railroad trains from so sudden and unforeseen obstructions. The safety of the trains can be best secured by requiring all persons, before crossing a railroad, to stop and ascertain whether the road is clear.

The 29th of August was a still day; there was but little wind, and the whistles of both trains, which were blowing as they saw each other, must have been audible all along the road on which this carriage was traveling from the river, about a mile to the crossing. Besides the repeated blowing of whistles, as sworn to by some of our most respected citizens, from the time the up train first passed the cross-road until its return, and the fatal collision occurred; there was at the crossing a board, with the inscription, "Look out for the locomotive."

The entire truth of the foregoing narrative is, we think, fully, completely, and satisfactorily proved, by the testimony of fourteen reliable men, taken before the Coroner's Jury; and it does appear to your committee that in all particulars the law of the State and the regulations of the Company were fully complied with by these agents and employees having charge of the trains on the 29th of August. The Coroner's Jury, it is true, say that the engineer did not observe the rules and the law respecting blowing the whistle. But they must have rejected the positive testimony of the following witnesses: Samuel S. Stryker, of Trenton; James Garwood, Dean Swift Read, Charles Alcott, Henry Henner, John R. Rodgers, John Rodgers, Hugh Costill, of Burlington; Allen Thompson, Lloyd Vandeveer, Prescott Harvey, Israel Adams, Samuel Scott and Maurice Maxwell, all of whom, except the three last, were entirely disinterested, and unconnected with the company, whose respectability and position forbid the idea that they could have been mistaken; to find that the whistle was not blown because other witnesses did not hear it, they reject positive proof of the fact, and assert that it did not take place, because others were not cognizant of its occurrence; this certainly is a most extraordinary conclusion.

The proper look-out on the part of the brakemen, conductor, and engineer, was observed; the speed was usual and lawful; the warning whistle was sounded, and all due diligence, vigilance and precaution were studiously and scrupulously practised. The train had the right to the track, and the engineer and brakemen were on the look-out along the line of the track. There their attention was required and was given. They were not bound to look to the right or to the left, at a distance from the track, nor is it compatible with safety, where there are usually so many cattle on or near the road, that their attention should thus be diverted. Their business is to concentrate their vigilance on the track. But it is quite evident that the scope of their vision, while thus directed would take in sufficient space to cover all objects within dangerous proximity to the track, except in just such a case as the one now under consideration, of headlong, impetuous, reckless velocity, precipitating an obstruction far beyond the scope of their vision, immediately in front of the train.

From such a case of intruding obstruction, unless apprized beforehand of the probability of its occurrence, it seems hardly conceivable how railroad trains, with any degree of vigilance, can protect themselves. Besides, had the brakeman observed the horses and carriage approaching upon the cross-road, is it probable that he would have deemed it necessary to warn the engineer? Could he have deemed it possible that any sane man, in possession of the senses of hearing and seeing, did not see and hear the train, and would not have held up short of the railroad track—especially as the ground was clear and smooth, and nothing to prevent the driver, even after he got close to the railroad, pulling his horses around to the right? "A quick check of the right rein would have thrown his horses parallel with the track," and avoided all danger. On the contrary, had the brakemen seen the carriage approaching, well knowing that the train had the right to the track, it is not presumable that he would have considered it necessary to give the engineer notice of its approach. If he had seen a cow or horse or other brute animal, *controlled only by his own instinct*, on, or approaching the track, he would have attempted to check or to accelerate the train. But if he saw at a distance those animals, apparently under the power and *control of human reason*, no danger was fairly to be apprehended. The law of the land, the dictates of common sense, and the demand of the traveling public, alike forbid the necessity of checking the train for every wagon that can be seen in the neighborhood of a track. There are two hundred and thirty-seven crossings by streets, public roads, lanes, and private crossings; the loss of one minute at each, would make the passage between New York and Philadelphia, eight hours instead of four hours.

There seems to be no reasonable doubt that the train was backing at a rate of speed not unusual or unsafe. This part of the track it must be remembered was straight, with new iron rails of 64 pounds to the yard, and in perfect order. It had just been passed over by the same train, and the track found safe and clear. Besides, there can be but little doubt that in meeting such obstructions on the road, that a higher rate of speed, which in case of collision would probably sweep the impediment off the road without injury to the train, is much safer than a low rate of speed, which would oblige the train to encounter and embarrass itself with the obstruction, without removing it from the track.

In view of the above facts, the Committee have reviewed the regulations of the Company, to ascertain if any, and what alterations could be suggested for the better protection of the passengers and trains; and they are constrained to say that they consider the present regulation better than any which has been proposed for running trains on single track roads, and that experience has proved them to be so, even in the recent case of disaster; because it is evident that it was the driver of the horses who caused the accident. Was this not so? Had he been at home, there would have been no accident. He alone is responsible, and the wisdom of the Company's regulations, and the faithfulness of the employees, will stand vindicated before the considerate judgment of an enlightened and moral people.

With this brief narrative of the circumstances attending the melancholy event of the 29th August, as proved before the Coroner's Jury, we might, perhaps, with propriety close this report. The subject, however, of safety on railroads is so connected with the feelings and business of our people, that it calls for a few additional remarks from us. To say that the Company is responsible for this accident because they have not built a double track, is to apply a rule to this Company, which is applied to no other companies. There are supposed to be now more than twenty thousand miles of railroad in operation in the United States, and but a small proportion of double track. Roads which carry many more passengers per annum than the Camden and Amboy Railroad, have no double track. Even upon the New York and Erie, and Hudson River Roads, there are not double tracks through the whole line; and we are not aware that there is any railroad in this country, which is so exclusively appropriated for the carriage of passengers as this road is, that has a double track. It is a fact, however, not generally understood, that the Camden and Amboy Railroad Company have now and have had for many years, two separate and independent lines for the transit of passengers between New York and Philadelphia. A portion of their trains pass over one track exclusively, and a portion over the other; and it is well known that incipient steps have been taken to construct two more tracks between Trenton and New Brunswick; which, including the Philadelphia and Trenton Railroad, will provide additional facilities between New York and Philadelphia, not in the expectation of preventing accidents, but to expedite the transit between the two cities. Nothing but the depressed state of railroad securities in the money market has prevented the prosecution of this work.

It is held, however, by many, that double tracks are not that guaranty for safety which is claimed for them; the necessity of backing the trains, even on double tracks, in many instances, cannot be avoided; switches, the most frequent cause of railroad accidents, must necessarily be multiplied. Certainly the statistics of railroad accidents, in Europe as well as in this country, seem to favor that idea. It may be added, likewise, that on double tracks the temptation to maintain high rates of speed is almost irresistible, and that high rates of speed are not as compatible with safety as low rates. The public demand, with reference to railroad travel, safety, cheapness, and speed. Double tracks are indispensable where high rates of speed are in use. But they are not compatible with cheapness or necessary for safety, where a limited number of trains per day are run, as is the case on our road. If lightning from heaven were to strike our cars, it would be as reasonable to say that the company was responsible for the result, because they have not fixed lightning rods to each car, as to say that the company is responsible for the recent accident, because they have not built a double track. As to the suggestion of placing a gate at each crossing, that can only be done by the Legislative authority, and we do not think that it would be as safe, as to require every person to halt, and to see that the train is not in sight, before he attempts to cross any railroad, as is the evident intent of the present sign boards required by law.

Every person would, in this case, have a perfect protection in himself; why diminish it by placing the responsibility elsewhere, and upon persons much less interested? As long as wood and iron are so fragile and defective, there can be no absolute safety in traveling at the present speed with which our railroad trains are driven. We would suggest, however, that the best means to obtain the desired safety, would be to alter the whole system of hostile legislation in regard to railroads, to consider them as useful public conveniences, entitled to the liberal support and just consideration of the people, and to that protection from the courts and juries which every American freeman has a right to claim; not as nuisances to be reviled without measure, and to be libelled and persecuted on all occasions, right or wrong; to make them exclusive; to fence them in from one end to the other; to take the public roads under or over them; to reduce the speed of the trains to twenty-five miles per hour, and to hold all persons trespassers, who, without authority from the Company, go on the road or suffer their cattle to go on it.

ROBERT L. STEVENS,	ROBERT F. STOCKTON,
EDWIN A. STEVENS,	JOHN R. THOMPSON,
JAMES NEILSON,	BENJAMIN FISH,
RICHARD STOCKTON,	JAMES S. GREEN.

Railroad Accidents.

On the 29th of August last, the passenger train which left Philadelphia at 10 o'clock, A. M., for New York, met with an accident near Burlington which resulted in the death of 23 persons, and serious injury to about 70 more. On the 10th of September, the Executive Committee made a report on the subject to the Joint Board of Directors, published in the daily papers, which, we think, should not pass without notice from this Journal. For this purpose, we re-publish it in this number. In noticing it, however, it is not our intention to dwell upon anything which relates merely to the disaster itself; that is past, and if retribution is to be exacted, it must be in due course of law, which we have no desire to forestall by prejudging the case either to condemnation or acquittal of any one concerned. Nor shall we dwell upon the tone of the report in question, which has been complained of as cold and unfeeling: but we desire to advert to parts of it, in which opinions are expressed as to the possibility of lessening the liability to accidents upon this and other roads, and the means to be used for such a purpose. For this purpose we accept the account of the accident given in the report, and shall follow the discussion.

In the first place, the Committee find in the circumstances of the accident, an argument in favor of the regulation of their road, by which, after a train has waited for an opposite one for a certain length of time, it may proceed; both trains having the right to the track, with the farther rule that when the trains meet, the one which has not reached the centre-post shall back to the next switch to allow the other to pass. The Committee maintain this as a good regulation, "as allowing the conductor to expedite his train without the least danger of collision."—But we differ from them in this, thinking that the accident which happened upon this road a few years ago, near Spotswood, clearly proves that the regulation is far from obviating the danger of collision; in fact, the experience of other roads shows that the result of such a regulation, is to cause the engine drivers to use undue speed as they approach the centre-post so as to avoid the trouble and mortification of running back, and thus to increase the danger of collision. Nor do we think that the records of the Company will show that such a regulation facilitates the rapid passage of the trains, and the making the connexions with the lines running on from the termini; on the contrary, we know of no road which has been so much complained of, as this very road has been, on account of falling behind the time of the departure of the Baltimore trains from Philadelphia; an event of such frequent occurrence, as to have induced the project of a new road across New Jersey to pass from New York to Washington without touching at Philadelphia, and thus led the New York press to lose no opportunity of exciting the public indignation against the Camden and Amboy Company and the monopoly of transit which they enjoy under the laws of New Jersey. We believe that a much more efficient and safe regulation would be, to require at least the conductor of each train which had a connexion to make, to run punctually to his time, (a point in which this road is sadly defective,) and so to arrange the times of reaching and leaving each station, that there should be no danger of collision. With a line of telegraph all along their road, we cannot see how such danger could occur; for instance, in the present case, it is stated, that the conductor knew that the train from New York "had left Bordentown at 10 hours and 56 minutes;" why not wait at Burlington, then, until that train, which could not be far off, reached there—giving way to that train, which had a connexion to make at Philadelphia, while the train toward New York had none.

The Committee admit that the train was backing at the rate of 15 miles an hour, which they seem to consider a safe rate of speed, but surely they have overlooked the various sources of danger in backing a train of cars, arising from the position of the engine—the loose connexion of the cars together. We find in the regulations of other roads, that it is expressly forbidden, under any circumstances, to back a train more rapidly than 6 miles per hour; and certainly, any speed much greater than this, must be unsafe, for, in the first place, the engine driver being behind, cannot receive timely notice of any suddenly discovered obstruction, and indeed cannot, unless very especial care be taken, receive any notice at all, for the rope which passes between the cars and engine, is slackened at least a foot for each car, in consequence of the slacking of the couplings and approach of the cars to each other, and as it is knotted between each car and passes through small holes or rings, will not run readily so as to affect the bell, whilst the dust of the train obstructs the view of any one from the engine. Then, again, the pushing motion of the engine, transmitted through the buffers, tends at any obstruction upon a single rail, as, by the catching of a flange or the pressure on a curve, to force the cars off the track. The old experience on the subject of pushing trains, was sufficient to cause, we believe, its universal disuse, except when a temporary necessity may arise upon a single-track railroad, and all experience seems to show that it is an expedient never resorted to without great danger, which danger increases very rapidly as the rate of speed is accelerated.

Another assertion of the report which strikes us as inaccurate, is that the engineer and brakesman "were not bound to look to the right or left, at a distance from the track, nor is it compatible with safety, where there are usually so many cattle on or near the road, that their attention should be thus diverted." On the contrary, when the engine-driver or brakesman know that they are approaching a crossing, we consider it as a very important part of their duty to give a careful scrutiny to the road so approached, especially when any one driving along that road would be apt to be misled into security by the recent passage of the train, which would seem to render the road clear from that quarter. The use of the whistle and a careful lookout seem to us essential in such a case, and if an accident should happen from neglect of them, we should, without hesitation, consider these officers as liable for its occurrence. (we do not mean to say, that such was the fact in this case, although the coroner's jury appear to have thought so.) But when the Committee go on to exclaim, "how impossible is it to devise means for the protection of railroad trains from so sudden and unforeseen destruction!" we must reply, no, gentlemen, there is a very simple and effectual way of fully guarding against the possibility of every such disaster—a way, which has been tested by experience, in countries where it is considered the duty of government to take human life under its protection, and should be required of you, and of all railroads running through thickly populated sections of country—it consists in passing all roads over the railroad by means of properly elevated bridges. This method would not be very expensive, certainly not too much so in view of the end to be attained; it would be, as it has always been found, effectual, and it ought to be adopted by all railroads: or if not willingly, then they should be compelled to adopt it by law. Until this is done, we agree with the Committee, that "the safety of the trains can best be secured by requiring all persons, before crossing a railroad, to stop and ascertain whether the road is clear."

The most extraordinary feature of the report, however, is the argument against a second track; they affirm that "the necessity of backing trains, even on double tracks, in many instances, cannot be avoided." How can this be the case, if the trains in one direction are kept on one track, and those in the other, upon the other, as in all well conducted roads they will be? The only case we can imagine, would be where a fast passenger train running for a connexion, should find itself obstructed by a train broken down on the track before it, and should run back to the nearest switch, pass on to the other track, and thus take the wrong track to pass the destruction. This would be a very dangerous method, but might be useful, and could be guarded only by despatching signals along the line before the backing train, and then running with extreme caution. Except in such a case, we cannot imagine the circumstances in which a train would have to be backed.

Another curious assertion is, that on a double track "switches must necessarily be multiplied." But why? Switches are used for three purposes; first, to accommodate a local trade, allowing cars to run out and stand upon a side track; secondly, to permit a slow train to get out of the way and allow a fast train overtaking it to pass; thirdly, on a road with a single track, to allow trains running in opposite directions, to pass each other. In a double track road, receiving no cars except at the termini, and running all trains at the same velocity, no switches would be necessary, (except to provide for accidents and repair of track). The two first categories belong to both double and single roads, the third to single roads alone. The number of switches on a double track road may, therefore, be less than on a single one, provided it be judiciously run.

Is it true, moreover, as the report asserts, that a double track is not compatible with economy? Is it not, on the contrary, the result both of reasoning and experience, that the longer time during which the rails will last makes them more economical for permanent roads having a travel in both directions? It is true that most of our roads are obliged to be started with single tracks, and made to earn the means of laying the second, but this is not now the condition of the road in question, whose profits, from their monopoly and good management, (for their pecuniary interests,) have made them so rich. As to the comparison with the lightning rods, we would accept it, and say decidedly, that if experience had shown that railroad trains were liable to be struck, and the passengers endangered by lightning, the company who ran their cars without lightning rods, would be very culpable. Now experience has shown that backing cars are very liable to accident, and it should, therefore, be as far as possible, avoided.

The ordinary accidents on a railroad may, perhaps, be reduced to three categories—first, from breaking an engine or a car, and thus crushing the train; secondly, running over an obstacle, by which the cars are thrown off the track and broken; thirdly, collision with trains running in other directions. Against the first, there is no perfect remedy, and the danger can only be abated, not entirely destroyed, by constant examination. The second is the most fertile source of accident, and will remain so, so long as the farmers will allow their cattle to have access to the railroad track, and so long as our people are so reckless in the manner in which they pass on, to, and across it. After obstacles are guarded against as far as possible by fencing the road and passing all other roads across it at a different level, we fully agree with the report, that the best means of remedying the danger "would be to alter the whole system of hostile legislation, &c." So long as a farmer could claim damages for the loss of a cow, which must have been on the track by his own fault or negligence, or an individual who has been injured by placing himself in a danger of which he must be aware, could get a verdict against a railroad, whose servants could not, by any possibility, avoid the accident, there can be no hope of any important reduction in this class of accidents; but this state of things we trust is now at an end, and we hope soon to see all the courts in the land join to make the individuals in question responsible to the extent of their abilities, for the actual or possible damage in such cases to the train. Then accidents of this kind will almost disappear, for all parties will be made more cautious, and the public mind will be more easily satisfied as to the fault of the engine driver or conductor. For the third class of accidents no effectual security can be found, except in a well-managed double track road; or if that be from circumstances, impossible, carefully digested rules, and the strictest authority exerted to compel the trains to run punctually to their time. Such a system would, we believe, render such accidents nearly impossible.

It appears to us, that the moral of the late fearful and deplorable accident which has furnished the text of these remarks is, first, the necessity of absolutely prohibiting any railroad from passing another road on the same level: Secondly, the necessity of legislation for the punishment of individuals who drive or ride across a railroad track, without first stopping to ascertain that it is clear: Thirdly, the expediency of so regulating the travel on railroads, that but one train shall have the right to the track at a given place and time, and of compelling all conductors to be punctual in their running.

Translated for the Journal of the Franklin Institute.

On the substitution of the Native Sulphate of Magnesia for Sulphuric Acid in the Manufacture of Hydrochloric Acid, Sulphate of Soda, Nitric Acid, and Chlorine. By M. Ramon De Luna.

In the experiments, the first results of which I have the honor of presenting, I proposed to myself both to economize the expense of transporting the sulphuric acid, and to find an industrial use for the sulphate of magnesia which is met with in several localites in Spain, especially in the province of Toledo near Madrid, along the line of the Mediterranean Railroad.

Manufacture of Hydrochloric Acid, and of Sulphate of Soda.—If a thorough mixture of two parts of crystallized sulphate of magnesia (or 1¾ parts of sulphate of magnesia slightly dried,) and one part of chloride of sodium be heated to redness, hydrochloric acid will be disengaged, and the residuum will be composed essentially of magnesia and sulphate of soda. Treated with water at 90°, (194° Fahr.) this residuum will yield, besides magnesia, sulphate of soda, and a little sulphate of magnesia which has escaped decomposition, the elimination of which may be obtained by the addition of the milk of lime, which will transform it into sulphate of lime, which is nearly insoluble, and magnesia. I have prepared by this process, more than 12,000 kil. (26,000 lbs.) of sulphate of soda, much purer than that of commerce.

Manufacture of Nitric Acid.—A mixture of two parts of crystallized sulphate of magnesia, (or 1¾ slightly dried) and one part of nitrate of potassa or soda, when heated to redness, yields nitric acid, accompanied by abundant nitrous vapors, sulphate of potassa or soda, and magnesia. From 200 grammes of calcined nitrate of soda, with 400 grammes of crystallized sulphate of magnesia, I obtained 90 grammes of nitric acid, marking 40° of Baume's areometer. When distilled, this acid yielded a colorless acid of 46°, and perfectly pure.

Chlorine may be obtained by heating strongly, a mixture of cloride of sodium, peroxide of manganese and sulphate of magnesia, as might be anticipated from the fact that these salts when heated alone yield hydrochloric acid. These actions, as will be seen, are the consequences of the little affinity which magnesia has for hydrochloric and nitric acids, compared with that of its analogues the alcaline and earthy bases; hence the sulphate of lime, so much more abundant in nature, cannot be used in its place, for these re-actions.

On the Existence of an Element of Strength in Beams subjected to Transverse Strain, arising from the lateral action of the Fibres or Particles on each other, and named by the Author the "Resistance to Flexure."

By PETER WILLIAM BARLOW, Esq., F.R.S.*

The author commences by observing, that under the existing theory of beams, which recognises only two elements of resistance, namely, tension and compression, the strength of a beam of cast iron cannot be reconciled with the results of experiments on the direct tensile strength, if the neutral axis is in the centre of the beam.

He then proceeds to describe experiments made on two solid beams of cast iron to determine the position of the neutral axis. The beams employed were 7 feet long, 6 inches deep, and 2 inches thick, on each of which small vertical ribs were cast, 12 inches apart; nine small holes were drilled opposite to each other in each rib, for the purpose of inserting the pins of a delicate measuring instrument. The distances of the holes of the centre division of both beams were measured under various strains, and the results show that the extensions and compressions proceed in an arithmetical ratio from the centre to the upper and lower sides of the beam; and that at any given distance on either side of the centre, the amount of extension is equal to the amount of compression.

The position of the neutral axis being thus conclusively ascertained to be in the centre, it is shown that, not only the ultimate strength, but also the amount of extension and compression with a given strain, indicates the existence of another element of resistance, in addition to the resistances to extension and compression.

The author then points out, that in applying the law of "*ut tensio sic vis*" to contiguous fibres, under the different degrees of extension and compression, the effect of the lateral adhesion has been omitted, and each fibre has been supposed to be capable of taking up the same degree of extension or compression as if it acted separately, and independently of the adjoining fibres.

It is then shown that this supposed independent action of the fibres is inconsistent with other practical results, and evidence is exhibited of a powerful lateral action when unequal strains are exerted.

From these and other considerations, the author is led to think that the effect of the lateral action, tending to modify the effect of the unequal and opposite strains in a beam, constitutes, in effect, a "resistance to flexure" acting in addition to the resistances of tension and compression.

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* From the Lond., Edin., and Dub. Philos. Mag., July, 1855.

In order to ascertain whether the apparent difference in the amount of tensile strength when excited by direct and transverse strains is due to *flexure*, the author caused open beams or girders to be made, each of which was formed by two bars of metal; the upper and lower bars of the same beam were in every case of the same form and dimensions; but the depth of metal and the distance to which the bars were separated vertically, was varied in the several forms of girder experimented upon. By these means the bar forming the lower side of each girder was torn asunder under different degrees of flexure. The different forms of girder experimented upon were of equal length, and were compared with solid beams and with bars of the same metal broken by direct tensile strain.

From the mean of *four* experiments on each form of girder, the value of the total resistance at the outer fibre is ascertained, and exhibits the following results:—

1. In girders having the same depth of metal, namely, about 2 inches, but the total depth of the girder, and consequently the deflections different:—

Form of beam or girder.	Depth of girder.	Deflection.	Total resistance at the outer fibre.
			lbs.
No. 1. Solid beam. .	2·02	·670	41,709
No. 2. Open girder, .	2·51	·510	35,386
No. 3. Open girder, .	3·00	·401	31,977
No. 4. Open girder, .	4·00	·301	28,032

2. In girders having the same total depth (namely, 4 inches,) and consequently nearly the same deflection, but differing in the depth of metal:—

Form of beam or girder.	Depth of metal.	Total resistance at the outer fibre.
		lbs.
No. 5. Open girder, .	3·01	37,408
No. 4. Open girder, .	1·97	28,032
No. 7. Open girder, .	1·56	27,908
No. 6. Open girder, .	1·48	25,271
The tensile strength of the metal employed was found to be		18,750

From these experiments, the particulars of which are fully detailed, the following facts are elicited:—

1. That in all cases the total resistance at the outer fibre, at the time of rupture, is greater than the tensile strength.

2. That in girders having the same depth of metal, it increases when the deflection increases; and

3. That in girders having the same total depth, and the same deflec-

tion, the resistance is greater when the depth of metal in the beam is greater.

And it follows that there is an element of strength depending on the depth of metal in connexion with the deflection; or, in other words, dependent on the *degree* of *flexure* to which the metal forming the beam is subjected.

The author next proceeds to examine the law under which this resistance varies; and considering the total resistance in the solid beam to be composed of two resistances, one being constant and due to the tensile strength, and the other variable and depending on the depth of the metal in connexion, with its deflection, the experiments indicate that the resistance to flexure varies, throughout all the girders, directly as the amount of deflection into the depth of the metal.

The paper concludes by pointing out the important amount of this resistance, the operation of which has been hithereto unknown, and which in cast iron exceeds the tensile strength of the metal, and shows that comparisons of the strength of different forms of section, based on the existing theory, which assumes the resistance at the outer fibre to be constant and equal to the tensile strength of the metal, must be entirely fallacious.

The paper is accompanied by full details of all the experiments, and the measurements for determining the position of the neutral axis.

On the Influence of Local Altitude on the Burning of the Fuses of Shells.[*]

In the early part of the year 1848, at the annual practice of the Artillery in this garrison, it was observed that the fuses burned too long a time. The regular burning of fuses being a matter of much importance, the circumstance was duly reported to Artillery Head Quarters, and a portion of each kind was directed to be sent to St. Thomas's Mount (eight miles from Madras and on the same level) for examination, where they were found to burn correctly, and as at that time no one suspected the real cause of the discrepance, it was concluded there had been some error in the length of our pendulum, and there, for the time, the matter rested.

But as I was satisfied, for many reasons, that it was not owing to an error in the pendulum, I determined to keep the subject in mind, and for the practice in the following year, (1849,) I caused to be made an adjustable pendulum which beat seconds very correctly for several minutes. This pendulum was daily compared with two or more seconds watches to make all safe, and, as our longest time of flight did not exceed twenty seconds, no error could possibly arise from this source. The result was that the fuses again burnt too long at Bangalore, and were again found to burn correctly at St. Thomas's Mount.

This was a mystery to all; but after the matter had cost me much thought, it occurred to me that the cause was to be sought in the difference of altitude between St. Thomas's Mount and Bangalore, nearly 3000 feet; and as a means of putting this to the test, I suggested that some fuses should be burnt at the Mount, or at Madras, under a receiver, exhausted until the barometer stood at the Bangalore mean height, or about 27 inches. This, however, it was not found convenient to do; but, as an equally satisfactory way of testing the accuracy of my conclusions, a small number of fuses were prepared and burnt at St. Thomas's Mount, at Bangalore, and at two different altitudes on the Neilgherry Hills, as will be seen by the annexed copy of an official memorandum; and, although this experiment was too limited to enable us to compile a scale of the probable times a certain length of fuse composition would burn at given altitudes, it amply proves the fact that combustion is retarded at considerable elevations.

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[*] From the Lond., Edin., and Dub. Philos. Mag., July, 1855.

Memorandum of an experiment to ascertain whether the atmosphere influences the burning of fuses:—

Eighteen 8-inch fuses, made of the same description of wood (Congo,) were filled with composition made for the purpose. The same man drove the whole on the morning of the 2d August, 1849, using the same mallet and drifts. Six of the fuses were burnt at the Mount, six at Bangalore, and six on the Neilgherry Hills; all in the presence of artillery officers; the result is shown below:—

Time.	Station.	Length of fuse.	Time of burning.	Barometer.	Thermometer.	Height above the level of the sea.
		ins.	secs.	ins.	°	
August 2, 1849. ½ past 12 o'clock.	St. Thomas's Mount.	3	14·15	29·78	89	Artillery Depot yard.
		3	14·30			
		3	14·30			
		3	14·30			
		3	14·15			
		3	14·30			
August 17, 1849. ½ past 5 P. M.	Bangalore.	3	16·00	26·89	82	3000 ft.
		3	0·0*			
		3	15·75			
		3	15·15			
		3	15·75			
		3	16·25			
August 31, 1849. ½ past 7 A. M.	Kotagherry, Neilgherries.	3	17·00	24·025	Att. 62·7 Det. 61·8	6500 ft.
		3	17·00			
		3	0·0*			
		3	17·30			
Sept. 8, 1849. 20 minutes past 8 A. M.	Cotacamund, Neilgherries.	3	18·00	23·030	54·2	7300 ft.
		3	18·25			

The writer attributes the result to the rarity of the atmospheric air, and of its constituent oxygen at the higher stations.

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* The fuses thus marked, accidentally ignited at both ends.

On the Position of Aluminum in the Voltaic series. By CHARLES WHEATSTONE, Esq., F. R. S.*

Having, through the kindness of Dr. Hofmann, been permitted to examine a specimen of aluminum prepared by M. Claire-Deville, I availed myself of the opportunity to ascertain one of the physical properties of this extraordinary metal, which it does not appear has been yet determined, viz: its order in the voltaic series. The following are the results of my experiments.

Solution of potass acts more energetically and with a greater evolution of hydrogen gas upon aluminum, than it does on zinc, cadmium, or tin. In this liquid aluminum is negative to zinc, and positive to cadmium, tin, lead, iron, copper, and platina. Employed as the positve metal, the most steady and energetic current is obtained when it is opposed to copper as the negative metal; all the other metals negative to it which were tried became rapidly polarized, whether above or below copper in the series.

In a solution of hydrochloric acid aluminum is negative to zinc and cadmium, and positive to all the other metals above named. With this liquid also copper opposed to it as the negative metal gave the strongest and most constant current.

Nitric and sulphuric acids, are known not to act chemically in any sensible manner on aluminum. With the former acid diluted as the exciting liquid, aluminum is negative to zinc, cadmium, tin, lead, and iron. The current with zinc is strong; with the other metals very weak, and it is probable that their apparent negative condition is the result of polarization. When aluminum is immersed in dilute sulphuric acid, this metal appears negative to zinc, cadmium, tin, and iron, but with lead, on which sulphuric acid has no action, the current is insensible. In both these liquids copper and platina are negative to aluminum, and notwithstanding the apparent absence of chemical action on the latter metal, weak currents are produced.

It is rather remarkable, that a metal, the atomic number of which is so small, and the specific gravity of which is so low, should occupy such a position in the electromotive scale as to be more negative than zinc in the series.

Monster Mortar Guns.†

The *Horatio* steam frigate is preparing, at Sheerness, to receive two of the monster mortar guns invented, and it would now appear already constructed, by Nasmyth. These guns are 10 feet 6 inches long, and in diameter at bore, 13 inches; muzzle, 31½ inches; base, 40 inches. The weight of each is about 23 tons. It is slung on Captain J. Robert's plan, and will throw a solid spherical shot of 302·4 lbs. with a charge of 30lbs. of powder. The construction of the bomb-proof iron-cased floating mortar-vessels has been kept very quiet, but we now learn that they are of exactly the same construction as the broadside iron cased batteries carrying sixteen Lancaster guns. The upper deck is so strengthened as to bear the weight of the heavy piece of ordnance with which it is armed. These mortar vessels, it is said, will throw bomb-shells a distance of four miles! With their guns, ammunition, and stores on board, the floating batteries will only draw 20 feet of water, so that the whole fleet of *forty* vessels can approach within a comparatively short distance of any of the marine Russian fortresses. Their cost has been enormous. A fleet of English and French line of battle-ships and smaller craft will accompany them. The mortar batteries are each 70 feet in length, 23 feet in width, and 9 feet 4 inches in depth. Several of these mortar batteries will be attached to the fleet of forty floating batteries propelled by steam. Their construction in the hull is the same, and their decks are bomb-proof. That they are destined for the Black Sea as well as the Baltic, we are still hopeful, though no official hint has even yet appeared to that effect that we are aware of. The British fleet for the Baltic will consist, it appears, of no less than a hundred vessels, every one of them propelled by steam.

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* From the Lond., Edin. and Dub. Philos. Mag., August, 1855.

† From the London Builder, No. 632.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, October 18, 1855.

John C. Cresson, President, in the chair.

John Agnew, Vice President.

John F. Frazer, Treasurer.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

A letter was read from the American Institute of New York, inviting the Institute to visit their Exhibition by delegation. The President was authorized to appoint a delegation.

Donations to the library were received from The Geological Society of London, and The Statistical Society, of London; Professor A. D. Bache, Washington City, D. C.; The Pottsville Scientific Association, Pottsville, Pennsylvania; Professor John F. Frazer, and Mr. P. S. Sanderson, of Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of September.

The Board of Managers and Standing Committees reported their minutes.

Resignations of membership in the Institute by 65 gentlemen were read and accepted.

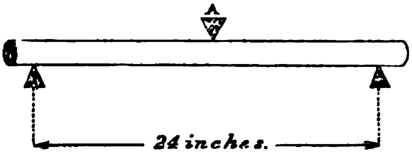
The candidates for membership in the Institute, (12,) were proposed, and the candidates proposed at the last meeting, (7,) were duly elected.

Mr. John E. Addicks, Chairman of the Committee on Exhibitions, offered the following resolution, which was adopted:

Resolved, That in consequence of being unable to procure suitable accommodations, the Institute is forced to decline holding an Exhibition for this year.

Mr. Macpherson stated, that wishing to obtain a strong composition mixture to be used for marine purposes, he had recently made the following experiments:

All the bars being turned to a diameter of 2 1/16 inches, and a length of 25 inches, the weight being applied at A, as shown:



No. 1, was composed of 10 lbs. copper, 10 oz. tin, 12 oz. zinc, 8 oz. lead, deflected quickly to 7⅝ inches, and broke with 6874 lbs. at A.

No. 2, was composed of 6 lbs. copper, 4 lbs. zinc, deflected slowly to 2 inches, and broke with 6489 lbs. at A.

No. 3, was composed of 2 lbs. copper, 1 lb. of zinc, deflected quickly to 7 9/16 inches, and broke with 6158 lbs. at A.

No. 4, was composed of 9 lbs. copper to 1 lb. of tin, deflected slowly to 4¼, and broke with 7802 lbs. at A.

No. 5, was composed of 10 lbs. copper, 1 lb. of tin, 4 oz. zinc, deflected slowly to 7½ inches, and broke with 10,530 lbs. at A.

No. 6, same mixture as No. 5, cast several weeks later, deflected very slowly to 7½ inches, and sustained without breaking or showing the least fracture, a weight of 11,695 lbs. at A.

No. 7, was composed of 8½ lbs. of copper, 8 oz. tin, 1 lb. zinc, deflected slowly to 5⅜, and broke with 6461 lbs. at A.

No. 8, same mixture as No. 1, with the addition of 1 lb. tin to every 12 lbs. of the mixture, deflected very slowly ¼-inch, and broke with 5333 lbs. at A.

A piece of refined bar iron of same length and diameter, deflected slowly to 4 inches, and sustained at A, a weight of 12,375 lbs., and by increasing the 17,000 lbs., it deflected to 5½ inches.

Mr. Macpherson exhibited specimens illustrating the results of these experiments.

Mr. M. B. Dyott exhibited a model of his improvement in warm air furnaces. This is at present under consideration by the Committee on Science and the Arts.

BIBLIOGRAPHICAL NOTICE.

New Canadian Mint Bill: International Coinage. Legislative Assembly of Canada, third and fourth report of Standing Committee on Public Accounts, W. L. Mackenzie, Chairman, ordered to be printed 12th April, 1855. Quebec, 8vo. 1855.

The tendency of the world at present seems very emphatically towards an abandonment of ideas, which have no longer any realities to support them, but are clung to merely from old habit and association; and towards the surrender of usages which have grown effete, and are no longer adapted to the practical demands of society. This tendency is not so much the fruit of reflection as the suggestion of convenience; it does not spring from within, outwards; but is probably a re-action from without, inward; and is motivated by the vastly increased intercourse, which the mechanical improvements of the last quarter century have allowed between almost all parts of the world, and which not only demands for its accommodation an assimilation and uniformity of symbols, but produces them.

It is in this way, by running to and fro, that knowledge, as the Scripture says, is increased; in this way, that the prophetic anticipations of divers closet speculators are discovered to be highly utilitarian, and that the tranchant ideas of the French geometers sixty years since—ideas wholly inapplicable and impossible in the then state of things, only now beginning to be carried out in their fulness over the restricted territory of France—will find their practical development. Mere theory or mere geometry can do comparatively little; and Man, (i. e. masses of men) is led by convenience and association.

This seems to be illustrated in the recent money-movement in Canada, referred to in the caption above. Twenty years ago, the movement was begun; actuated by a desire to remedy a commercial state, no less confused and inconvenient than the present, but then without success; now, the agencies of steam and electricity, the construction of railroads between the United States and Canada, and the recent adoption of the Reciprocity Treaty, have promoted such a diffusion of intercourse between the Republic and the Province, that the population of the latter seem to be almost unanimous in their wish to assimilate their own currency to that of the former.

It was very natural, in the early Provincial settlements and arrangements, that the same method of accounts should be used, as in the Mother Country. But the intercourse of the Provincialists, individually, came gradually to be far less with that Mother Country than with the neighboring States, where different methods prevailed; and so the £ sterling and its irregular subordinates grew less familiar than the American denominations and a decimal subdivision. It is useless to speculate on the curious probable destiny of the Dollar, to become hereafter the universal nominal unit of value and exchange, and equally unnecessary to detail the advantages of the decimal over the duodecimal count. The latter are so manifest, that the natural tendency of assimilation which would any how have shown itself, was greatly facilitated; until, in point of fact, the greater part of Canadian business-ideas repose upon the Dollar, even though in conformity with law, it has to be translated, for actual transactions, afterwards into pounds, shillings, and pence.

In order to render such translation more ready, and also from a want of a sufficient circulation of sterling coins, (which produced the same result in Canada that it has ever done in all colonies, viz: an appreciation of actual coin,) a pound currency was devised, which should be an integral multiple (four) of the dollar; and it is with this £ which represents $ 4. U. S. while the £ stg. is $4·86⅔, that the public accounts in Canada are kept. In point of fact, the last act on the subject, that of 1853, goes a step farther, and blends the denominations together; making the legal coins, pounds (currency), dollars, shillings, pence, cents, and mills. Such a union, unless regarded merely as a step towards something else, can only produce a hybrid; which, as it appears from the document whose title is given in the note to the caption here, really exists.

The minting of these legalized coins, unless we are to take account of certain copper tokens (not coins) issued by some Banking Institution, is done in England; of course, the amount of circulating medium is imperfect, inadequate; and the Provinces are very much dependent upon the adjacent States for their supply of coin, with this further disagreeable concomitant, that it is not the coin of their realm, and is liable to be withdrawn according to the fluctuations of trade in those States.

Amid these inconveniences and the confusion between £ stg., Halifax currency, York shillings, copper tokens, and four or five different provincial usages and exchanges which still farther complicate the matter, Mr. Mackenzie has very zealously taken up afresh the laudable aim of reconcilement. And the method he has fallen upon is equally practical and unexceptionable, viz: the collection through a circular correspondence of numerous opinions of men in business, as to the effect of the change and the best mode of bringing it about. As to the former topic, there appears in the correspondence printed and forming a part of the Report referred to, no difference of sentiment: upon the latter, there is nearly equal unanimity in recommending the adoption at once of the existing monetary system of the United States. The Report closes with the following resolutions, which we understand to have been passed by the Legislature, and only to await the Royal approval; viz:—

"Resolved, That after the 31st day of January, 1856, there shall be but one currency of accounts and payment, of which the Dollar shall be the unit and standard of value; the public accounts shall be kept in dollars, cents, and mills; and the coinage be equal in intrinsic value to that of the United States.

"Resolved, That the ton of 2240 lbs., the cwt. of 112 lbs., the half cwt. of 56 lbs., and the quarter cwt. of 28 lbs., be reduced to a ton of 2000 lbs. and its subdivisions."

Whether these resolutions will meet approval and so go into effect, we here cannot advisedly speculate. The English character is to be among the last to give up old usages and peculiar habits; and we have seen in the recent discussions touching the proposed change in the Imperial monetary system, how decidedly this character is exemplified.

It is to be regretted that the Canadian movement did not contemplate the results of this discussion more nearly; and, by a greater comprehensiveness of aims and purpose, include also and contribute directly to such a modification as would have blended the existing Imperial and Republican currencies into one; whose elements, identical in value, would be interchangeable, though called by different names, in all the vast territories under English and American control. We should then have three great nations,—for the Canadians are a nation in fact, and must become one soon in form—exemplifying the reasonableness and convenience of an International Coinage; and thus marking the most distinct and emphatic epoch that has ever occurred in the History of Commerce. A.

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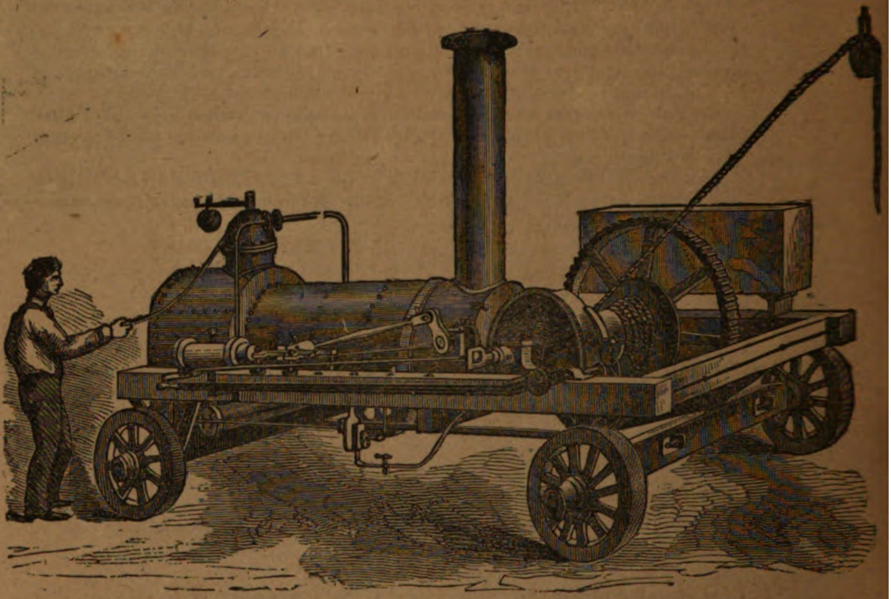

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References,—Prof. J. C. Cresson, Supt. Phila. Gas Works; Thos. I. Potts, Iron Merchant; Pierce Butler, Esq.; Rob. Kelton, 113 N. Water st.; H. Haupt, Chf. Eng. Penn'a. R. R. Co.; L. G. Mytinger; A. S. & W. L. Roberts, 80½ Walnut St.; Wm. Mahone, Chf. Eng., Norfolk & P. R. R. Co.; S. B. Sutton, St. George's, Del.; C. P. Morton, Mortonville, Chester County, Pa.; Sam'l. Entriken, Paoli, Pa.; Richard Hecksher, Minersville, Pa.; J. Dutton Steel, Esq., Civil Eng. Phila. & Reading R. R. Co.; R. B. Osborn, Chf. Eng. Dauphin & Susq. R. R. Co.; F. Fraley, Pres. Sch. Nav'n Co.; S. A. & W. Henderson, Norristown; Spencer & Mason, Pottsville; G. D. Coleman, Lebanon, Penn.; J. J. Holland, Williston, S. C; Maj. John Jones, Md.

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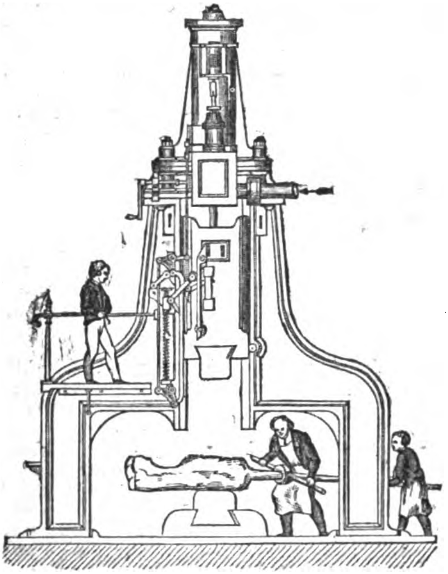

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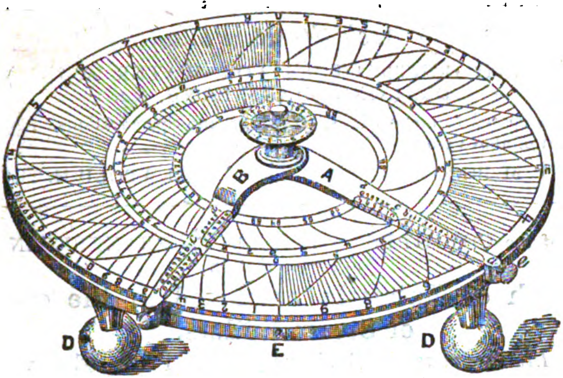

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JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

DECEMBER, 1855.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

An Account of the Measurement of two Base Lines in Florida, Section VI, United States Coast Survey. By FAIRMAN ROGERS, Civ. Eng. The information from the Archives of the Coast Survey, communicated by authority from the Treasury Department.

The great importance of extreme accuracy in the measurement of a base line, for any extended geodetic operations calls for an apparatus, which shall overcome the three following difficulties:

First: The difficulty of determining the exact length of the measuring apparatus with reference to any fixed unit, or to a quarter of the earth's circumference, to which all geodetic distances must be referred.

Second: The avoidance of error from change of length in the apparatus, with variations of temperature and moisture. And,

Third: The very nice manipulation required in the field, to make the contacts or coincidences so perfect that there shall be no chances of error in the practical measurement; a view being had at the same time, to economy of time and labor in the use of the apparatus.

In the operations of the United States Coast Survey, the French metre has been adopted as the unit, its length being more accurately determined than that of any other standard. Its value, as compared with the American standard, is 39·36850154 inches. The metre being at 32° Fah., and the inches at 62° Fah. In the outset, this comparison of the metre with the foot, is a matter of great difficulty, owing to the want of coincidence of the several English and American standards.

The difficulty of making a bar of metal so nearly equal in length to another bar as to differ by a quantity inappreciable in a single length, is not very great; but when this discrepancy, however small, comes to be multiplied by one or two thousand, the number of bars in a base line, the error becomes very sensible, it being, unlike most instrument errors, a cumulative one.

The method adopted for making this comparison of length will be described farther on.

The second difficulty, that of keeping the apparatus at a given length in spite of the changes of position, temperature, and moisture, or of making a perfect correction for these changes, has always been a great one.

Various means have been tried. Steel chains very carefully made, are found to be very unsatisfactory in practice, owing to the difficulty of keeping them uniformly stretched, of supporting them throughout their entire length, and of determining and applying the correction for temperature.

Glass rods have been tried, giving no better results.

Deal or other wooden rods are rather less accurate than either, as they are very readily affected by the varying moisture, and will warp and twist in all directions.

As an illustration of these changes, I give the following comparison of the different lengths of the same base measured on Hounslow Heath, English Ordnance Survey:

With deal rods, . . .	27405·7607	feet.
" glass rods, . . .	27403·38	"
" steel chain, . . .	27402·38	"

The difference between the measurement with deal rods and the steel chain being 3·3807 feet in a base of about five miles.

To obviate this difficulty, arising from change of length with the temperature, the principle of compensation already used in the pendulum, was introduced by Captain Colby, in the apparatus for the measurement of the Lough Foyle Base in 1827. Two bars, one of iron and one of brass, fastened together in the middle and free to move at the ends, carry at each end a "lever of compensation," so proportioned to the expansion of the two metals, that while they move relatively to each other, a fine platinum point on the lever maintains an invariable distance from the centre of the apparatus, and consequently, from the point on the lever at the other end. That is, the distance between the two platinum points is invariable and independent of the change of temperature. Using two sets of these bars in the measurement, the points on each are brought within the proper distance of each other by means of two microscopes mounted on a compensating bar of a few inches in length.

This apparatus gave moderately good results, but was not very convenient in use, owing to the difficulty of setting the microscopes in making the coincidence with sufficient rapidity.

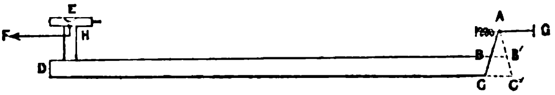
A compensating apparatus on the same general principle, was constructed by Simeon Borden, Esq., Civ. Eng., of Massachusetts, and used by him in the survey of that State in 1830.

The "rules" of Borda made for the survey of France, were constructed on rather a different principle. The rule or bar itself was of platinum, the expansion of which metal by heat had been determined with much care, and close alongside of it, and attached firmly at one end, was a bar of copper, the coincident edges of the bars at the free end, being divided in arbitrary divisions read by a vernier on one bar ; this constituted in fact a metallic thermometer, and the changes of temperature of the platinum were read on the scale, and the proper correction for temperature thus determined.

In none of these arrangements, had any attention been paid to the different specific heats of the composing metals. In Captain Colby's apparatus, the absorbing qualities of the rods were partially equalized by the coatings of varnish upon their surfaces, but their cross sections were exactly the same.

In the years 1845, 1846, Professor Bache having taken charge of the operations of the survey of the coast of the United States as Superintendent, determined by a long series of very careful experiments, the relative cross sections of the bars of iron and brass, which were to constitute a new base apparatus for the use of the survey, depending upon their differences of specific heat and conducting power, the absorbent qualities of their surfaces being adjusted by the use of different colored varnishes.

The apparatus as it now exists was arranged by the Superintendent, and made in the Coast Survey office, under the direction of Mr. William Würdemann at that time mechanician of the survey. It consists primarily of two bars, one of iron, the other of brass, about nineteen feet long, firmly fastened together by means of a piece at one end, and perfectly free to move past each other longitudinally in expanding or contracting, being hung on rollers in stirrups from the iron truss frame which stiffens the whole apparatus. The skeleton diagram here given will serve to show the relations of the several parts.



In this diagram the relative proportions of the parts are not preserved, it being much distorted in order to show the arrangement more clearly.

D B is the iron bar, D C the brass bar, firmly united at D; at C, the lever of compensation, A C is jointed to the brass bar, and its polished steel surface at B, is kept pressed against the end of the iron bar D B, by the spring represented near A, which is so attached to the small rod A G, which has a slot in the middle wherein the end A of the lever works, that it constantly acts to draw the rod back, and the end of the lever along with it. The arms of the lever A B and A C are proportioned to each other as the expansion of iron to brass. A B : A C : : 1100 : 1748, or very nearly, as the expansions given by Smeaton of iron ·00125800, and by Laplace of brass ·00186671.

So by reference to the diagram it will be seen, that when the iron bar expands by heat from B to B′, the brass bar will have expanded from C to C′, and the arms of the lever being properly proportioned to these expansions, the point A of the lever will not be moved, but will keep exactly its normal distance from D. The expansion of the iron rod G, is allowed for in the arrangement, and it carries upon its end G, a polished agate plane rather less than a quarter of an inch in diameter, which is the surface of contact at that end of the apparatus.

We now come to the third difficulty mentioned, that of making the contact or coincidence of the ends of the bars, so that it shall be accurate, safe, and convenient, for the method of operation must be by placing one in the line to be measured with one end directly over the starting point, and then bringing the second in the line, and accurately coinciding with the end of the first, either by actual contact, or by being kept at an invariable distance by means of reading microscopes.

Microscopes as used by Captain Colby and by Mr. Hassler on the old coast survey apparatus, are inconvenient and difficult to adjust with speed and accuracy, and in devising the present apparatus, Professor Bache applied the contact level of Bessel, which had been hitherto used for the purpose of observing comparisons of length. The action of this level is shown in the diagram.

F H is a small iron rod similar to A G, but carrying an agate knife edge, with its edge horizontal, instead of a plane. E is a small delicate level moving on a centre, represented by the small black dot between E and H, and supported from the bars. From the lower side of the level a short arm projects, against which the end of the rod F H abuts; the inside end of the level is weighted, so that it naturally assumes an inclined position and pushes the rod F H out, any undue motion being prevented by stops. The distance between the two agates is therefore always a little more than the standard length, six metres, and it is so adjusted that when the rod is pushed in, moving the level in the manner of a bell crank, the bubble stands in the middle when the agates are just the proper distance apart; in short, the position of the bubble in the centre of its run indicates the accurate adjustment of thé length. In reality the contact level is not fastened directly to the bars themselves, but to the bar of a very delicate sector level, the centre of motion of which is exactly in the axis of the agates, and which is kept always level, so that the inclination of the bars, which is sometimes unavoidable on uneven ground, does not affect the position of the contact level. This sector level serves also to show the inclination of the bars from the horizontal plane, in order to apply the correction for versed sine.

These constitute the essential parts of the apparatus. The bars are suspended in stirrups from a plate iron truss frame, which keeps them steady, and the whole is enclosed in a double tin tube with an air space between the two parts to prevent sudden changes of temperature being communicated to the bars, with glass doors in the middle and at the two ends, for the purpose of reading the enclosed thermometers and observing the contact. From the fact of these tubes being the visible part of the apparatus, each piece of apparatus is technically called in Coast Survey parlance "a tube," a base being said, for instance, to consist of so many tubes, meaning so many times six metres.

To each *tube* at a distance of about five feet from each end, is lashed underneath it and transversely, a bar or *handspike*, by which the tube is carried, four men acting as *bearers*. Close to this handspike, and at the rear end of the tube, are a pair of trunnions running transversely, which fit into corresponding horns on the rear trestles, and at the forward end a plate with two holes which fit on two projecting pins on the top of the fore trestles. The trestles are tripods of iron, the legs resting on foot screws, and capable of elongation by a telescopic arrangement worked by a rack and pinion, and a vertical main screw which raises the head, which has the two motions of a slide rest in the horizontal plane, the transverse motions of both trestles, and the line motion of the rear trestle being governed by screws, precisely like those of a slide rest, and terminating in square shanks to which the handles may be fastened. Each trestle carries a small circular level for adjustment. Eight trestles are required. Ten cast iron plates made to receive the foot screws of the trestles, a wooden frame for placing the foot plates in the proper position, and a wooden bar with a sector level upon it for setting the trestles at the proper distance and level to receive the tubes, complete the equipment.

Upon first arriving on the ground, the comparisons of the tubes with the standard iron six metre bar, are made for the purpose of insuring that no change has taken place during their transportation.

For this purpose two stone or hard wood pillars are sunk in the ground, at a distance of six metres apart and properly protected from the effects of surrounding vibrations by wooden boxes around them in the ground.

Fixing the points of the compass for convenience, at a distance of twenty feet north from the east pillar, another pillar is sunk, the tops of all being on the same level, and about the height of a trestle from the ground. Two trestles on their foot plates are placed in the proper positions in the line between the pillars, and the tube placed upon them. On the top of the west pillar is a brass plate with a vertical part, through which passes the *abutting screw*, a steel screw with a square end made perfectly perpendicular to the axis of the screw, and adjusted so as to be in a vertical plane.

The agate knife edge abuts against this screw. On the top of the other pillar is fixed a plate carrying a vertical standard supporting a small mirror, which turns upon a vertical axis through a small arc, an arm projecting from the back of the mirror carrying a fine screw with a rounded end, which rests against the agate plane of the east end of the tube, a spring keeping it always against the plane.

On the third, or north pillar, which is at right angles to the line of the tube, and opposite the east pillar, is a small theodolite telescope with a vertical hair, so placed that a graduated paper scale placed directly underneath it, can be seen through the telescope reflected in the mirror. All being arranged, the standard iron bar supported in its box is put in the "*comparator*," levelled by the trestle screws, and the end made to abut against the screw on the west pillar; the *mirror screw* resting against the agate plane, a certain part of the scale is reflected in the mirror, and read through the telescope, by its coincidence with the vertical hair; this reading is noted, as is also the temperature of the bar at the ends and the middle as indicated by the attached thermometers; the bar is then taken out and one of the tubes substituted; this is moved in a longitudinal direction, until the contact level is brought exactly right by the pressure of the knife edge against the agate plane, and the reading of the scale as reflected into the telescope again taken; the difference of reading gives the difference of length between the *tube* and the *standard.* The bar is then again put in, and this is repeated a great many times with each tube, the exact length of which compared with the standard reduced to a constant temperature being thus determined. There are sixty of these scale divisions to 11·68 inches on the scale, so that the actual length of each division is very nearly one-fifth of an inch, and therefore very easily read. Owing to the difference of length between the arm on the back of the mirror, and the distance between the mirror and the scale, one scale division corresponds to a change of length in the bar or tube of ·000157 of an inch, giving the means of ascertaining with great delicacy the minute changes in length in the bar.

This arrangement of mirror and scale, is known as Saxton's pyrometer, and has been before used in magnetic observations.

The comparisons are usually continued for two or three days, and the results afterwards reduced in the office. These being finished, the actual measurement is begun, the end of the base has already been marked in some permanent manner, and the line has been carefully ranged out as in running a tangent on railroad work.

A good transit is set up on a continuation of the line run forty or fifty feet back, and adjusted to bear upon the signal at the other end of the base or upon the proper range marks. Stubs have already been driven at distances of about 200 metres along the line and the centres accurately marked.

The tubes are ranged in line with the transit, by means of two sight vanes which they carry at their forward ends, the plates are laid in the places where the advancing tubes are to come, and the four trestles not in use are placed upon them. A transit instrument is then set up in a line at right angles to the base at its beginning, and about forty feet from it, and the agate knife edge brought carefully over the point in the copper bolt beneath it. The agate plane on the forward end of the first tube is exactly six metres from the copper bolt, the second tube is then drawn back by means of the distance screw of the trestle, until the contact level reads level, when the agate plane of its forward end is exactly twelve metres from the bolt, the number of tubes, the temperature, and the inclination, or the note, level, if there is none, is recorded.

The Superintendent makes the contacts during the whole of the operation. So much being ready, the Superintendent when the contact is perfect says "*made,*" "*break,*" whereupon the assistant at the rear end of the first tube draws it rapidly back by means of the distance screw.

The trestle screws have long handles with a universal joint which can be stuck on to any screw at pleasure.

The plate represents the measurement at the moment of making contact, the figure at the extreme left being the assistant, holding the distance screw just ready to turn off at the word "*break.*" The handle of the main screw for adjusting the level is attached to the trestle and rests on the ground at his feet.

The Superintendent, in a stooping position, is observing the contact level through the small window in the rear end of the second tube, and moving the tube slowly in the line by a fine motion screw with his left hand to make the contact. The first assistant is seen moving from his place at the forward end of the second tube to the forward end of the first tube, to take charge of its advance, upon hearing the order "*break*," while the assistant is turning off, the four bearers, only two of which are represented in the drawing, advance to their places on each side of the tube. The first assistant having arrived at his place, turns the tube out of the line by means of the azimuth screw in the front trestle until the Superintendent says "*clear;*" the order is then given to the bearers "*raise forward*," "*step out*," "*raise aft*," "*step out*," "*forward*," and the bearers supporting the tube by the handspikes carry it past the other tube to its place in front; the assistant at the rear hastily detaching his two handles and following the tube, holding on to it to guard against accidents from a bearer stumbling.

"*Halt*" is then called; the trunnions of the tube are placed in the horns of the rear trestle, and the tube is slowly swung into its place, the Superintendent watching the agates closely to see that all is clear; when all is right the bearers step aside, the tube is aligned by the observer at the transit; the level adjustments are made by the assistants with their trestle screws; the contact is made roughly by the rear assistant with his distance screw, and he goes back to his old place as represented in the sketch, ready to turn off again at the word "*break*."

In the meantime as soon as two trestles are disengaged by the advance of the tube, four trestle men immediately carry them forward, and place them upon the plates already set for them, as is shown in the drawing, and two plate bearers stepping inside of the plates, which are hollow, lay them in their proper places in the wooden frame which guides them, a man preparing the beds for them with a hoe. An officer with the bar carrying the sector level, sets the trestles at the proper distance and level, for the reception of the tubes, and arranges the adjustment of the trestles to suit the varying nature of the ground. When the tubes cannot be exactly level, the inclination is read and noted, and the correction or the sum of the corrections, which is the sum of the versed sines of the angles of inclination to a radius of six metres, is subtracted from the measured length. The temperature, number of tubes, inclinations, &c., are recorded by an assistant who is shown on this side of the tube.

On leaving the tubes for breakfast and dinner, a stub was driven under each end of the last tube, and an ordinary lady's dressing pin driven into it, exactly under the agate as aligned by a transit instrument, placed at right angles to the line.

At night more permanent marks were made by driving three stubs, one under the end of each tube and one under their intersection, and marking the points projected by the transit upon copper nails driven in them.

The tubes are allowed to remain in their places all night, covered by their india rubber cloths, a guard being left with them in any country where there is danger of their being disturbed.

On commencing operations the next morning, the points are verified by the transit instruments and the measurement continued as before.

At every distance of 268 tubes, or about a mile, granite mile stones are sunk with the point carefully projected upon a copper bolt, and further fixed by two stubs in the line and two at right angles to it, the intersection of the lines passing through them marking the point.

At the end of the base, if that end has been already marked and connected with the triangulation, the distance between the point and the end of the last tube is carefully measured with a fine beam compass.

The apparatus is then carried to the comparing tent, and two or three days spent in careful comparisons with the standard, while the other assistants make the marks permanent and set the monuments, marking the ends of the base.

On referring to the map of Florida, it will be seen that the great chain of Florida Keys commences at Key Biscayne, (Fort Dallas,) near the south end of Florida, in latitude 25° 39′, longitude 77° 03′, and sweeps off in quite a regular curve of nearly a quarter of a circle to Key West, in latitude 24° 32′, longitude 81° 47′, extending, in fact, in a few scattered keys to the Dry Tortugas. The main land runs in a southerly direction, to a point opposite Carysfort Reef, and then turns suddenly to the west as far as Cape Sable, which is the extreme southernmost point of the main, leaving Florida Bay and Barne's Sound, quite considerable sheets of water, between the reef and the main.

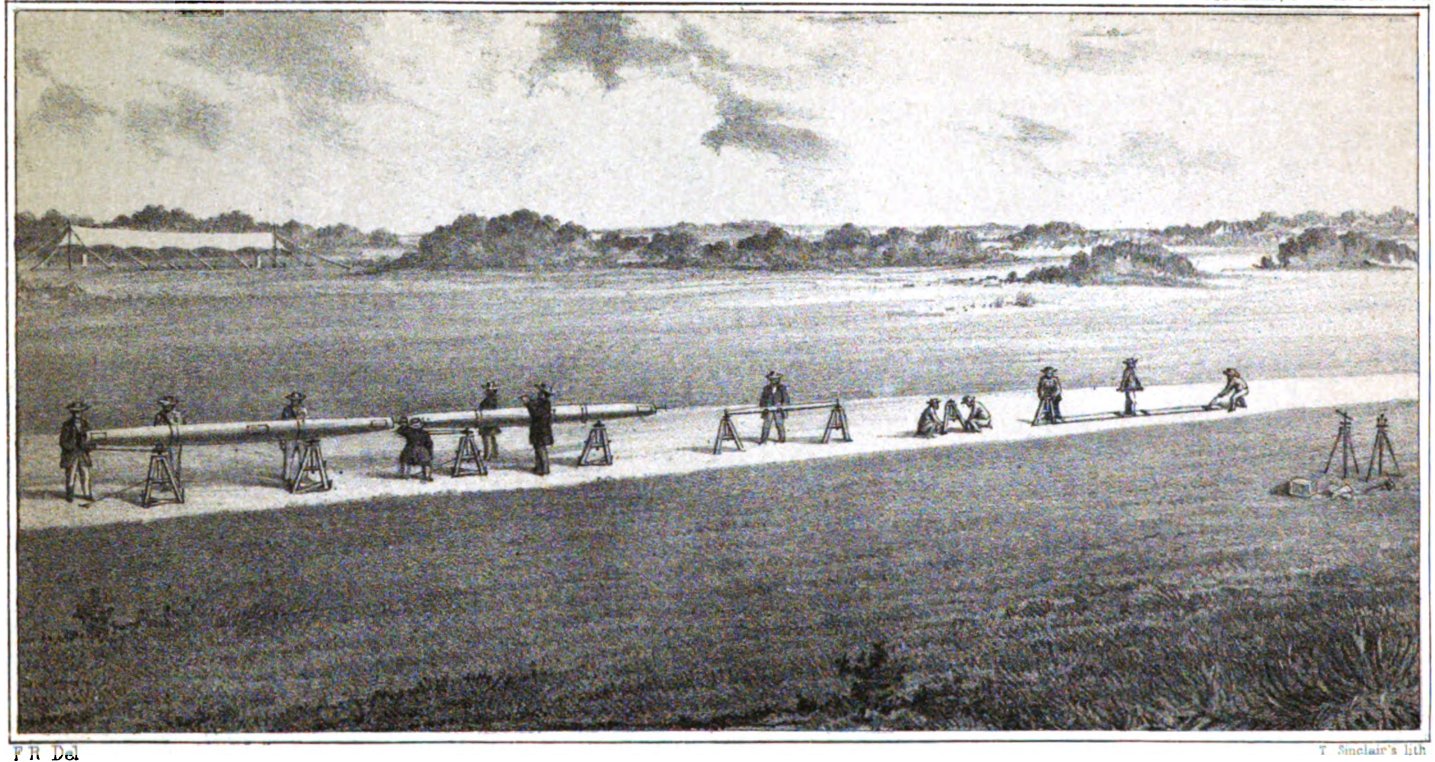
Outside of the range of keys, and about ten miles from them, runs the Florida Reef, which is of coral rock, and extends almost to the surface, the dread of all coasting vessels, which, in order to get into the Bay of Mexico, must enter the narrow passage between Cuba and the reef.

The dangers of this coast have always been considered very great, and the number of shipwrecks is proved by the extensive wrecking business that has always been carried on at Key West.

The determination of the positions of these reefs and keys is, of course, an object of great importance, and is attended with considerable difficulty on account of the entirely uninhabited condition of the Keys, the flatness of the country, and the immense amount of detail requisite for the proper delineation of the Keys. For the purposes of the triangulation sites for two bases were selected, one on Key Biscayne and one on Cape Sable, and that on Key Bescayne measured with iron wires, connected with the triangulation which was based upon it, and the south end occupied as an astronomical station.

Preparations were made for the final measurement of these two bases with the base apparatus in the Spring of 1855, and accordingly, the Superintendent, who always conducts the base measurements himself, with his party arrived at Key Biscayne on the 2d of April, and immediately commenced operations.

The camp had already been pitched on the sea shore near the south end of the base, which ran nearly north and south. The island is entirely uninhabited, except by the light-house keeper and his family, and covered on the north-west side with dense forests of black and red mangrove, and on the south-east with a thick growth of the scrub fan palmetto, with here and there a sea grape tree and a few bushes. A fine sandy beach, not of great width, extends along the eastern side, on which the base, on which the secondary triangulation of the Keys rests, had previously been measured with iron wires.



F R Del T. Sinclair's lith

MEASUREMENT OF A BASE U. S. COAST SURVEY.

Moment of Making Contact.

The line had been grubbed and graded throughout nearly its whole length of three and a half miles, and both ends marked in the usual manner by copper bolts let into heavy stone monuments sunk to the level of the ground and capped with a small stone pyramid, so that they could be again found.

South Base had been previously occupied as an astronomical station, and its latitude, longitude, and azimuth determined. The line was also chained and levelled for the profile. It was arranged that the measurement should be commenced at North Base, so that we should work towards camp, and after the comparisons were finished, the tubes, trestles, &c., were taken there in a flat towed by the schooner.

The actual measurement was now begun. At four o'clock in the morning, the summons to turn out was given, and by half past four all the party were on the way to North Base, a distance of about four miles from camp. Arrived there, the tubes which had been placed in the line the day before, were uncovered, and the transit set up in the continuation of the line, as mentioned, the position of the first tube over the initial point adjusted by the transit across the line, the levels of the sectors tested with an engineer's level, and the measurement commenced as before generally described. The work was continued until eight o'clock; from eight to nine was devoted to breakfast on the line; the work then resumed until one; dinner on the line from one until half past two, and operations resumed until about five, making about eight hours a day of actual work. The work of the first day or two lay through black mangrove woods and swampy ground, and the mosquitoes and sand flies tried the patience of the observers sorely; the trees, too, cut off the sea breeze, and, although in the shade, the thermometer stood at an average of 84°·5 F. At night the tubes were covered up, the trestles dressed in their triangular canvass covers, and left without any guard, as there were no inhabitants to disturb them and no signs of any Indians.

After leaving the woods and coming out upon the open plain, which was covered with scrub palmetto about four feet in height, through which the path was cut, the heat was, at times, very oppressive even when tempered by the sea breeze. Nine days were employed in the measurement, half a day being lost on account of rain, and half a day from an accident to the apparatus, which, however, was repaired without much delay. The end of tube 965, reached beyond the marked point of South Base, and being projected on a stub in the ground, the distance 0·34775 metres was measured back with a beam compass.

The last tube was set in the afternoon just in time to finish and get the tubes into camp before dark.

In camp the comparisons were resumed and resulted very satisfactorily, the sandy ground being extremely firm and the posts consequently stable. An improvement was made in the scale by lengthening it so as to bring on the whole range of the changes instead of part of the range, being read from the terms of the mirror screw, as was the case before.

The whole apparatus was then packed up and despatched in the schooner Bowditch to Cape Sable by the Duck Key passage.

The Superintendent proceeded to Cape Sable by way of Key West, coasting along the reef and inspecting the triangulation and topography.

At Saddle Hills near Key West word was brought him from Cape Sable that the condition of the prairie at that place, would make the measurement impossible, for the ground, which is but little above the level of the sea, was only a pasty mass of mud, owing to the heavy rains. Such information was very discouraging, but preparations were made for immediate departure for the scene of difficulty, and after a delay of a short time at Key West owing to a continuous north-east gale, the schooner swung at anchor a few hundred feet from Fort Poinsett, a mythical kind of establishment on the point of Cape Sable, consisting of an embankment forming two sides of a triangle and capable of holding about a hundred men.

Here things were found to be in rather better condition than was anticipated, the rain had ceased, and the ground had attained a sufficient solidity, for the purposes of the measurement.

The absence of the camp, which was to have been pitched, was satisfactorily accounted for by the tales of the musquitoes, which were described as exceeding anything of the kind in any other part of the world.

A party, consisting of an officer and several men, which had been left on shore with a camp for two days and nights, were taken off in a state of absolute exhaustion from want of rest, having spent all night in combats with these fearful insects.

The whole party had therefore to content themselves with their rather restricted quarters on the schooners, which were anchored about a mile out in the bay to avoid these flying marauders, which would have troubled us at a shorter distance from land.

As it was uncertain how long the fine weather would last, it was determined to commence immediately with the measurement and to postpone the comparisons until the end, and very fortunately, as the event showed, as, when the levels were run over the line after the measurement, the ground had already become somwhat soft from rain, and the last day on shore was memorable for a drenching rain, which fell much to the annoyance of the parties who were finishing the operations.

Cape Sable Prairie, as far as it has been explored, is a strip of five or six miles in width, between the sea and the everglades, bounded on the west by the sea, and extending an indefinite distance towards the east, a doubtful sheet of water called White Water Bay, the position of which is rather a matter of uncertainty, being to the north of part of it and the everglades completing the northern boundary. It is an exceedingly beautiful place, apparently made for the site of a base line, as smooth and level as a floor, and carpeted with a great variety of plants and grasses, some of which change their colors with the different stages of growth and give beautifully varied hues to the ground.

Mangrove hammocks of varied shapes and sizes spot the prairie at intervals, the appearance of which is pretty well shown in the accompanying sketch. These hammocks are filled with a variety of orchids or air plants which grow in great abundance on the trees, the cactus, whose short stinging pines interfere much with the passage through them, and the Spanish bayonet, whose magnificent white spike of flowers frequently shows out against the dark mangrove. But this beautiful place is cursed with musquitoes, so that we found it impossible to begin work on shore until nine o'clock, A. M., and necessary to stop by five in the afternoon; after this time clouds of them issued from the woods, and assailing any individual who was unfortunate enough to be on shore, drove him to the boats in a state of impotent rage.

The measurement here was briskly carried on, the level nature of the ground making the operation very rapid, the average time of one tube being 2 minutes 51 seconds against 4 minutes 20 seconds at Key Biscayne, and many of the tubes were made in less than two minutes. An average of 2 minutes 51 seconds would make about one-tenth of a mile an hour, but in some of the hours, as much as one-eighth of a mile was done, showing a rapidity of measurement hitherto unapproached in any of the base measurements with other forms of delicate apparatus. Eight days were occupied in the measurement of this base, which is 1072 tubes or 6432 metres in length, a trifle short of four miles. The ends of the base and the first and third miles were marked by iron screw piles sunk level with the ground, and filled with concrete, a copper bolt being fixed in the centre on which the point was marked, two smaller piles in the line and two across it, marked still further by the intersection of the lines through their centres the ends of the base. The second mile being the centre of the line and on firm ground was marked by a granite monument.

The annexed table gives the comparison of the measurements of the bases at Dauphine Island, Bodie's Island, and Edisto, with the Florida Bases.

	Dauphine Island.	Bodie's Island.	Edisto Island.	Key Biscayne.	Cape Sable.
Whole number of tubes measured,	1777	1807	1787	965	1702
" " " days employed, .	17	10	13	9	8
" " " hours " .	143 h. 17 m.	81 h. 08 m.	97 h. 28 m.	66 h. 31 m.	46 h. 26 m.
" " " tubes level, . . .	961	1496	862	473	994
" " " " inclined, .	816	311	925	492	78
Average length of working day, . .	8 h. 25 m. 7 s.	8h. 07 m.	7 h. 30 m.	7 h. 23 m.	5 h. 48 m.
" " " time of one tube,	5 m. 32 s.	2 m. 54 s.	3 m. 22 s.	4 m. 20 s.	2 m. 51 s.
" number of tubes per day, .	104·5	180·7	137·5	107·2	134
" " " " " " of 9 hours, ...	108·0	197·9	165·9	130·0	200
Average number of tubes per day of 9 hours, ...	11·85	21·98	18·4	14·4	22·47
Temperature of attached thermo'r,	84° 5 F.	52°·0	59°·5	82°·9	87°·9
Average tubes per hour of greatest day's work, ...	18·4	30·7	22·3	17·7	29·9
Greatest day's work, miles, . . .	0·70 mile.	1·06 mile.	0·75 mile.	0·68 mile.	0·73 mile.
Date, ...	May, 1847.	Nov., 1848.	Jany., 1850.	April, 1855.	May, 1855.

Neither of the bases were measured more than once, partial re-measurements on other lines having shown the probable error to be so exceedingly small as not to be important, it being noted as about one-tenth of an inch for the entire base.

Six officers, including the Superintendent, and about sixteen men are required for the operations in the field, besides those in the camp or on the vessels, cooks, &c. In the sketch a number are omitted to prevent confusion, and the officer at the transit aligning the tubes is too far along the line to be visible.

The Cape Sable Prairie is well stocked with deer, numbers of which were seen every day, and a sufficient number shot to keep the party in venison for some time.

The Indians, if there were any in the neighborhood, kept carefully away, perhaps deeming the party too strong for them, although they must have been attracted by the clouds of smoke which rolled up from the prairie which we had set on fire for the purpose of clearing it.

The long walls of flame as seen at night from the vessels, added very much to the beauty of the scene.

One large black bear, which fell a victim to the men who pursued it into the water and despatched it with boat hooks and oars, a few coons, some wild cats, and forty-three alligators, which a reconnoitering party saw holding a caucus in a creek, were all the wild animals that we met with.

On the 17th and 18th of May, all the operations being finished, the party left Cape Sable on their way to the north, everything having been accomplished without any accidents or serious sickness, although all the men were from the north and unused to out-door work in such a warm climate.

The triangulation based upon the original Key Biscayne base, measured with wires, has been carried on down the reef, and that base having been connected with the new one, the small correction necessary for the sides of the triangles can be applied, it being too small to affect the topographical work.

It may not be amiss in concluding this article to give the references to articles on the measurement of bases and the different forms of apparatus that have been devised for that purpose.

L. B. Francœur, Traité de Géodésie, p. 129, and Notes sur le Mesure des Bases, in the same volume. Frome, Outline of Trigonometrical Survey, p. 5. Aide Memoire to the Military Sciences, London, Art. Surveying. Lieutenant Hunt's Description of Apparatus and Plate of Details, U. S. Coast Survey, Report for 1854, p. 103. Hackley's Trigonometry, p. 316. Everest on Arc of Meridian in India, 4to., p. 50. Captain Yolland, Lough Foyle Base. Palfrey's Tables, Survey of Massachusetts. Trans. Am. Phil. Soc., Vol. ix, p. 34. N. Am. Rev., Oct., 1845, p. 458. Coast Survey Reports, 1847, p. 39; 1848, p. 43; 1849, p. 38; 1850, p. 34. Recueil des Observations Géodesiques, par Biot et Arago. Base du Systeme Métrique Decimal. Puissant, Geodesie, p. 203. Davies' and Peck's Dictionary of Mathematics, pp. 61, 272.

Sounding Rapid Currents.[*]

To the Editors of the Philosophical Magazine and Journal.

Gentlemen,—Seeing an account, which is making the tour of the newspapers, of an attempt to sound the depths of Niagara, which failed in consequence of the great velocity of the stream not allowing the plumb to sink, it struck me that that which could not be accomplished by main force, might be done by a very simple contrivance.

The principle on which a schoolboy's common kite mounts in the air, overcoming the law of gravity, is well known; and I should think that an apparatus constructed on the same principle, and perhaps of a like form but much smaller, and strongly made of iron, would by the action of the current of water be forced to the bottom of the river. All boys know that the stronger the breeze, the higher the kite flies. The depth might be easily determined by the angle of the detaining chain or wire, with the surface of the water. I merely throw out the hint, hoping it may perhaps lead to the invention of some apparatus that will overcome the difficulty.

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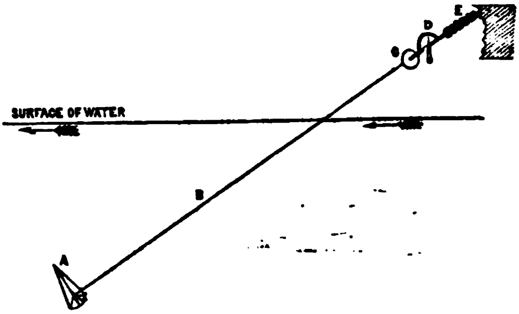
[*] From the Lond., Edin. and Dub. Philos. Mag., August, 1855.

I enclose a rough diagram, and remain, sirs,

Your obedient servant,

W. Sowerby.



A. Kite, strongly made of thick sheet iron,

B. Detaining chain or wire.

C. Reel fixed at the end of bar carrying the scale D, with a pointing needle weighted to keep perpendicular.

E. Chain and hook to attach the apparatus to the shore or bridge.

AMERICAN PATENTS.

List of American Patents which issued from October 23d, to November 13th, 1855, *(inclusive,) with Exemplifications.*

OCTOBER 23.

84. For an *Improved Dovetailing Machine;* John Bell, Harlem, New York.

Claim.—"The combination of the box clamp or frame, or its equivalent, for holding the pieces to be dovetailed or tenoned with the series of rotating cutters. Also, in combination with the double inclined tables, the double set of rotating cutters having the planes of the edges of the cutters working parallel with said tables."

85. For an *Improvement in Scythe Fastening;* Cyrus Clapp, Montague, Mass.

Claim.—"The fastening of scythes to snathes by means of the concave socket and section of a ball to which the scythe is attached, and the centre bolt."

86. For an *Improvement in Felting Hat Bodies;* William W. Cumberland, Newark, New Jersey.

Claim.—"1st, The arrangement and combination of the hollow cone and solid cone placed within it, the larger ends of said cones being uppermost, having a wedging space between them of a proper size and angle, whereby the hat body, placed between them in the wedging space, will tend to tighten itself by its own weight in the space, as it is rolled between the cones. 2d, The combination and arrangement of the yielding roller frames with the table, one of them having such a motion around the shaft as to eroze or change the position of the hat body by the friction of the rollers upon the hat body upon one side, and the friction of the hat body on the table on the other side. 3d, The combination of the weights, the roller frames, levers, and the pivots attached to the cone, for the purpose of lifting the weight of the cone, and thus diminishing the friction of it upon the collar of the shaft on which it rests below. 4th, Partially felting hat bodies, enclosed in their more tender state, in a hollow elastic cone of vulcanized india rubber, or other suitable material, lined with cloth, the larger and uppermost, in which the hat body is placed in an open conical form, corresponding to that of the cone by means of a process of bending or crimping, produced by the revolution of the elastic cone between two surfaces at a less distance from each other than the diameter of the cone, but not so near to each other as to cause the sides of the hat body within it to rub against each other, or the hat body to form itself into a roll."

87. For an *Improvement in Coal Lifters;* John B. Creemer, Philadelphia, Pa.

Claim.—"The dish and feet, in combination with the screen."

88. For an *Improvement in Gas Regulators;* Julius C. Dickey, Saratoga Springs, New York.

Claim.—"The valve chamber cast in one piece with the perforated plate, in combination with the adjustment of the valve placed outside."

89. For an *Improved Daguerreotype Plate Vise;* Samuel S. Day, City of New York.

Claim.—"The combination of the clamp with the screw rod, bow, and cam piece, to hold the daguerreotype plate between and beneath the lips."

90. For an *Improvement in Finishing Carpets;* Samuel Fay, Lowell, Mass.

Claim.—"Giving to woven figured fabrics, such as carpets, the finished appearance derived from the application of heavy pressure, whilst placing the goods in a roll for convenience of transportation, and without distorting the pattern by an irregular undue stretching of the fabric."

91. For a *Card Printing Press;* Thomas Harsha, West Union, Ohio.

Claim.—"Attaching the box which contains the form to the lever, and connecting said lever with the ink rollers and feed rollers, so that when the lever is moved and the form brought over the ink bed, the paper will be fed over the bed on which the paper is printed, and when the lever is moved over the bed, in order to print the paper or cards, the charged ink rollers will pass over the ink bed, whereby the ink bed is kept properly charged with ink, and the paper fed over the bed on which the paper is printed, and the paper or cards printed by simply moving or operating the lever. Also, passing the paper between two knives arranged in relation with the lever, so that the printed paper or cards will be cut off in proper lengths, as the form is pressed upon the paper, the knives cutting off a previous impression at each depression of the lever."

92. For an *Improvement in Melodeons;* George G. Hunt, Wolcottville, Conn.

Claim.—"The construction, whereby two, four, or more sets of reeds may be operated by one and the same valve."

93. For an *Improvement in Safety Apparatus in front of Railroad Cars;* Charles Mahon, Washington, D. C.

Claim.—"The peculiar and novel combination and arrangement of the vertical and horizontal rollers with the bar."

94. For an *Improvement in Seed Planters;* Daniel B. Neal, Mount Gilead, Ohio.

Claim.—"The arrangement of the shovel, the slotted and grooved slide, and gauge slide."

95. For an *Improvement in Sealing Preserve Cans;* Stimmel Lutz, Philadelphia, Pa.

Claim.—"Sealing of a double sided can or jar at the outside, at or near the bottom."

96. For an *Improvement in Preparing Cotton Seed for Extracting Oil;* Oscar Reisenbach, Norriton Township, Pennsylvania.

Claim.—"The application of sulphuric acid or acids in general, to free cotton seed as it comes from the cotton gin, from all surrounding cotton fibre, previous to the extraction of oil from the seed."

97. For an *Improved Machine for Sweeping Gutters, &c.;* Robert A. Smith, Philadelphia, Pennsylvania.

Claim.—"1st, An adjustable gutter brush, made to conform to or correspond with the shape of the gutter to be swept, so constructed and arranged, that it may be removed from and applied to the end of the shaft which carries it with facility. 2d, The guard or gauge wheel, arranged so as to prevent the gutter brush from being carried too hard against or over the curbstones, so as to derange or injure it. 3d, So arranging the gutter wheel by means of an angular axle, that the lowest portion of the tire, and the lower portion only, will come in contact with the curbstones."

98. For a *Machine for Composing and Setting Types;* William S. Loughborough, Rochester, New York.

Claim.—"1st, The presentation of the type cells in the machine, those of each case in the font forming the arc or segment of a circle. 2d, The means which shall deliver the types from the various cells into the jaws of the transits fixed to a wheel or other rotary motion, for conveying the types from the slides to the galley or composing chamber. 3d, The combination of the lever, head, tappets, and springs, with the line register, and its appurtenances, the lever, rule, or justifier, detent, and the index, and index plate, whereby the operator is enabled, simply, by touching the keys, to do the entire business of composing types, and without a transfer of each line separately."

99. For an *Improvement in Elastic Diaphragm Steam Pressure Regulators;* Joseph Woodruff, Rahway, New Jersey.

Claim.—"The chains as arranged in relation to the cupped edge or convex surface of the piston, for controlling and guiding the piston and keeping it in its central position, without coming in contact with any substance to cause friction when operated upon by the diaphragm."

100. For an *Improvement in Whipple-Trees;* George H. Yard, Trenton, N. J.

Claim.—"The traversing slide provided with a point fitted to the pole in the hook, in combination with a sliding pin to fasten it when the end of the slide is put into the hook to fasten the end of the trace on to the hook."

OCTOBER 30.

101. For an *Improvement in Rice Hulling Machines;* Robert Anderson, Brooklyn, New York, and John E. Anderson, City of New York.

Claim.—"The adjustable segmental concave faced with india rubber, in combination with the spiral springs, and a ratchet faced hulling cylinder."

102. For a *Machine for Manufacturing Corks;* William R. Crocker, Norwich, Conn.

Claim.—"The application of the revolving cylindrical cutters to cut corks from a block or slab, whether the cutters are slit or cut tapering or conical, or unslit, to cut cylindrical corks. This mode of construction, use, and application, allowing myself the privilege of varying the same in detail, while the principal and distinguishing characteristics are retained."

103. For an *Improved Device for Gauging and Setting Saw Mill Dogs;* Luther B. Fisher, Coldwater, Michigan.

Claim.—"The spring bar, in combination with the ratchet rim and lever stud."

104. For an *Improved Method of Hanging Mulley Saws;* Isaac N. Forrester, Centreville, Virginia.

Claim.—"The manner or mode of hanging saw blades by forming thereon, or attaching to the front edge only of one or both ends, devices, which I term saws or guide flanches, and the working or applying the same in grooves or guide places, whereby the back edge and principal part of the saw blade is free and unstrained and without any rigidity or stiffness, other than that of the blade itself."

105. For an *Improvement in Cooking Ranges and Air Heaters;* Julius Fink, Philadelphia, Pennsylvania.

Claim.—"The arrangement of the dust bar and exit flue leading from the passages surrounding the oven, within the air heating chamber. Also, in combination with a hot air chamber, which is heated by conduction, and independent of the heated or burning gases which pass around the oven, the carrying of said gases back and up through a flue located in said hot air chamber, for the purpose of re-heating the gases and causing them to ascend more rapidly by their rarification."

106. For an *Improvement in Straw Cutters;* Luther B. Fisher, Coldwater, Mich.

Claim.—"Ear, in combination with angular groove pieces, and rock shaft."

107. For an *Improvement in Machinery for Braiding;* Liveras Hull, Charlestown, Massachusetts.

Claim.—"Arranging and applying a rotary spring, pulley, and a tripping stud, or its equivalent, and tubular guide journal, with respect to the bobbin and its spring pawl, and so as to operate therewith."

108. For an *Improvement in Nut Machines;* Robert Griffiths, City of Alleghany, Pa.

Claim.—"The tables with the boxes and punchers, whether connected together or not."

109. For an *Improvement in Surface Condensers for Steam Engines;* Peter Hogg, City of New York.

Claim.—"The arrangement of two or more coils or worms of pipes within a surrounding vessel, when the several coils are in succession coiled of a smaller diameter and placed one within the other and each separately attached at top and bottom. Also, causing the condensing water, which enters the surrounding vessel, to travel around in the said vessel."

110. For an *Improvement in Locks;* Richard G. Holmes and William H. Butler, City of New York.

Claim.—"1st, Arranging the spindle or arbor of the lock in such a relation with the bolt, that the bolt may be operated by drawing and pressing the spindle or arbor in a direction transversely with the casing of the lock. 2d, The cylindrical bolt; also, connecting said bolt to the spindle or arbor by means of the lever. 3d, The employment or use of the sector tumblers when attached to a sliding plate and used in connexion with a spring, which is acted upon by the bended or inclined projection at the side of the bar or casing, for the purpose of preventing the lock being picked by obtaining a knowledge of the position of the slots in the tumblers, by pressing the tumblers singly against the plate."

111. For an *Improvement in Lamps;* John Stuber and Thomas Hardin, Utica, N. Y.

Claim.—"The use of tube connecting the drip-cup with the reservoir. Also, the arrangement of tube, in combination with the rod."

112. For an *Improvement in Looms;* James O. Leach, Ballston, New York.

Claim.—"1st, The combination and arrangement of the shifting lever, connecting rod, and eccentric, operated by the gearing, or their mechanical equivalents, for the purpose of varying the movement of the loom harness or heddles, so as to produce solid or tubular fabric with the same warp, and vary the solid or tubular weaving, so as to produce bags of any desirable capacity. Also, the mechanism for determining and regulating the intervals between the shift of the cams, viz: stops on the shaft of the eccentric, governed by a stop lever, being operated by a horizontal cam, which is itself turned by a ratchet wheel whose pawl is driven by the oscillating motion of the lathe, in combination with the partially toothed level wheel."

113. For an *Improvement in Ventilating Railroad Car;* H. L. B. Lewis, Philadelphia, Pennsylvania.

Claim.—"The peculiar construction and arrangement of the ventilating box or case. Also, a reciprocating curved deflector adapted to be moved only horizontally to right or left for directing currents of air into the car."

114. For an *Improvement in Ring and Traveler Spinning Frames;* Henry Luther, Providence, Rhode Island.

Claim.—"Combining with the twisting mechanism and the delivering rollers, or mechanism of a ring and traveler spinning frame mechanism, a mechanism which, while the cop or bobbin increases in size, shall so increase the rotary movements of the spindles and the delivery rollers, as to maintain uniformity in the twist and strain of the yarn."

115. For an *Improvement in Sewing Machines;* L. W. Langdon, Rochester, N. Y.

Claim.—" 1st, Making a stitch by tying a half knot or a whole knot at the will of the operator. 2d, The snail worm on the revolving vertical face plate, for the purpose of holding the thread until the knot is tied and the casting it off in time for the stitch to be drawn up. 3d, The vertical face plate into which the shuttle is set for the purpose of carrying it around, and the re-action of the looper for quickening the motion of the shuttle as it passes the needle, for the purpose of letting the looper pass out freely. 4th, Feeding the material by the needle when combined and arranged with the lateral motion of the needle, that is to say, in connexion with the rock shaft, with the sliding step in the end, the connecting rod of the spring, the set screw and rollers, the cams, the sliding bar, and the adjustable lever."

116. For an *Improvement in Stoves;* William Mootry, City of New York.

Claim.—" The application and employment of iron work, or other regular metallic cellular interstices, in combination with stoves, furnaces, and other heating and cooking apparatus or such heated surfaces generally."

117. For an *Improvement in Lamps for Burning Volatile Liquids;* E. N. Horsford, Cambridge, Massachusetts, and James R. Nichols, Haverhill, Massachusetts.

Claim.—" 1st, The combination of the safety wick tube with the safety tube or casing around it. 2d, The combination with the safety tube or casing, the perforated safety chamber with its tube barbed at the top, to contain and hold the wick in place, 3d, Making the wick tube in two parts or divisions, separable or not, so as to form the safety chamber in which the barbed portion of the lower wick tube terminates."

118. For an *Improvement in Corn and Cob Mills;* George Patten, Washington, D. C.

Claim.—" The double surfaced breaker and crusher between the upper portions of shell and burr, in combination with a shell and burr, as specified."

119. For a *Spoke and Axe-Helve Machine;* Owen Redmond, Rochester, New York.

Claim.—" 1st, The partially revolving bed constructed, arranged, and operating, so as to submit different pieces of wood to the action of the cutters at its forward and backward movements. 2d, The bed having a laterally swinging spring plate, in combination with the adjustable guide, for submitting curved timber to the action of rotary cutters in direction of its curve. 3d, The curved bed, traversing with an undulating movement, for submitting curved timber to the action of rotary cutters."

120. For a *Method of Ventilating Railroad Cars;* J. K. Taylor, Bridghampton, N. Y.

Claim.—" The vertical slotted tubes placed at the outer side of the windows of the car and having air forced through them."

121. For an *Improvement in Roofing Compositions;* James West, Syracuse, N. Y.

Claim.—" The use of lime, in combination with the rubber, gutta percha, and shellac solutions."

122. For an *Improved Lath Machine;* Aretus A. Wilder, Detroit, Michigan.

Claim.—" As my improvement in re-sawing and bringing plank to an equal width, at the same time, is the flanched brad rollers with their springs, or equivalents, in combination with the adjustable back rest."

123. For a *Machine for Cutting Double Tenons;* C. P. S. Wardwell, Lake Village, New Hampshire.

Claim.—" The combination and arrangement of the intermediate obliquely set or drunken saw, with the clearing or finishing true circular saw for operation together, and whereby the drunken saw not only serves to largely reduce the wood between the tenons, as required, for the completion of the tenons, but to form a wider kerf or pathway for the axle of the finishing saw to admit of the deep insertion of the latter into the wood, and of its operation as a clearer between the double tenons during the continuous progress or feed of the timbers."

124. For an *Improvement in Bedstead Fastenings;* John W. Yothers, Spruce Grove, Pennsylvania.

Claim.—"In connexion with the screw rollers or tenons on the ends of the rails, is the combination of the tubular segmental nuts and the buttons with each other and with the posts, in such a manner, that by turning the said buttons, the rails can be secured with their knobs in any desired position, and by the act of thus securing the rails, the buttons themselves will be drawn so closely against the outer surfaces of the posts, as to make perfectly tight and insect-proof joints between the buttons and the posts."

125. For a *Machine for Feeding Paper to Printing Presses;* Henry W. Dickinson, Assignor to Lansing B. Swan, Rochester, New York.

Claim.—"The general arrangement of the devices described."

126. For an *Improved Burglars' Alarm;* Daniel E. Eaton, Assignor to self and Perley O. Eaton, Boston, Massachusetts.

Claim.—"Arranging both the igniting sector and escapement hammer on one rotary shaft, (controlled by a spring) in combination with so arranging the wick tube, the match holder, and the escapement rod, that immediately after the trigger bolt has been withdrawn from the escapement hammer, not only shall such hammer be thrown over upon the top of the escapement rod, but the igniting sector be caused to discharge the extinguisher off the wick tube."

127. For an *Improvement in Gas Brackets;* John R. Hunter, Baltimore, Maryland, Assignor to Samuel R. Blair, Philadelphia, Pennsylvania.

Claim.—"The use of the parallel arms or tubes, in combination with the revolving joints, so as to make the bracket or fixture self-sustaining in any position or elevation, and, at the same time, maintaining the burner in its level position, so as not to disturb a glass or shade."

128. For an *Improvement in Sugar Filters;* Charles E. Bertrand, City of New York.

Claim.—"The combination of a series or system of three or more filters with the arrangement of steam, water, and saccharine juice pipes, and their appurtenances, admitting of a continuous circulating motion of the liquid to be filtered from one filter into any of the others, until a clear and fair filtration is obtained; and, also, admitting of the working of the filters backward or forward, at pleasure, either from the top to the bottom or in the opposite direction, for the purpose of partially reviving the purifying properties of the charcoal until fully exhausted."

129. For an *Improvement in Cider or Wine Mills;* Samuel Krauser, Reading, Pa.

Claim.—"1st, Communicating a reciprocating as well as a rotary motion to the guiding disks. 2d, The use of the grinding disk with its peculiar movements, in combination with the two stationary sieves. 3d, The use of the stationary sieves for the purpose of pressing the whole or a part of the pumice through their meshes, and also causing them to assist in reducing the fruit to a pumice by providing their inner surfaces with sharp projections. 4th, The arrangement of the skeleton concave with reference to sieves. 5th, In combination with operating the screw by means of two vibrating tumblers, the use of the catches. 6th, In combination with the side screens, the application of the scraping wheels."

RE-ISSUE FOR OCTOBER, 1855.

1. For a *Machine for Sawing Lumber;* Pinney Youngs, Milwaukie, Wisconsin; dated January 30, 1855; re-issued October 2, 1855.

Claim—"The employment of two pairs of shifting guides substantially as herein described, in combination with a circular saw, alternately in opposite directions. Also, setting the log or timber by means of the two screw shafts geared and operated by griping pawls, which act against stops at the end of the motions of the carriage, in combination with the arms and adjusting slides, to determine the degree or extent of set intended to be given to the log. And, also, in combination with the method of setting the log at the end of the several motions of the carriage, the method of throwing the setting apparatus out of gear by the bar which carries the log, to prevent the said bar with the holding dogs from approaching too near to the saw."

DESIGNS FOR OCTOBER, 1855.

1. For *Metallic Covers for Jugs;* Orrin Newton, Pittsburgh, Pennsylvania; dated October 9, 1855.

Claim.—"Making metallic covers and pitchers of the shape and pattern shown in the drawings."

2. For *Ornamenting Daguerreotype and other Mats;* Hiram W. Hayden, Waterbury, Connecticut; dated October 9, 1855.

Claim.—"The design of the ornaments surrounding the opening in the matting; and also, the design of the ornament formed on the surface of the matting.

3. For *Burial Cases;* Martin H. Crane, Assignor to Crane, Breed & Co., Cincinnati, Ohio; dated October 9, 1855.

Claim.—"The form and configuration of metallic burial case represented."

4. For *Cooking Stoves;* James Wager, Troy, New York; dated October 16, 1855.

Claim.—"The ornamental design and configuration of cook stove plates shown."

5. For *Cooking Stoves;* James Wager, Troy, New York; dated October 16, 1855.

Claim.—"The ornamental design and configuration of cook stove plates as represented in the drawing."

6. For *Parlor Stove Plates;* James Wager, Troy, New York; dated October 16, 1855.

Claim.—"The ornamental design and configuration of parlor stove plates."

7. For *Stove Plates;* Calvin Fulton, Assignor to Samuel McClure, Rochester, New York; dated October 30, 1855.

Claim—"The ornamental design of a stove plate, as represented."

8. For *Coal Stoves;* James Horton, Assignor to Leibrandt, McDowell & Co., Philadelphia, Pennsylvania; dated October 30, 1855.

Claim.—"The combination of ornaments, the whole forming an original design for a coal stove."

9. For *Stoves;* Andrew O'Neill, Assignor to O'Neill and Hunter, Portsmouth, Ohio; dated October 30, 1855.

Claim.—"The design for doors, top, and side plates of a stove."

10. For *Cooking Stoves;* Ezra Ripley and N. S. Vedder, Troy, New York, Assignors to "Johnson, Cox, Lasley & Co.," City of New York; dated October 30, 1855.

Claim.—"The combination and arrangement of the several ornaments and mouldings, as described, the whole forming an ornamental design for a cook stove."

NOVEMBER 6.

1. For an *Improvement in Machines for Sawing Marble;* Henry Burt, Newark, N. J.

Claim.—"The combination of the saw frame, pivoted, swinging, adjustable guide frames, and connecting rods, arranged and operated in the manner and for the purpose set forth."

2. For a *Method of Heating Air for Blast Furnaces;* Thomas W. Bakewell, Cincinnati, Ohio.

Claim.—"The heating of air to supply furnaces, by bringing the escape steam of an engine into direct and intimate contact therewith, in a suitable vessel, separate from the furnace, and previously to its admission thereto."

3. For an *Improvement in Whiffle Trees;* George C. Barney, Brookline, Mass.

Claim.—"Making a whiffle tree in two parts, and constructing them together and to the cross bar of the shafts."

4. For a *Bench Plane Iron;* J. Henry A. Bleckmann, Ronsdorf, Prussia.

Claim.—"The placing of a piece or a plate of steel between plates of iron, forming a plane iron."

5. For a *Lath Machine;* Andrew Blaikie and Walter Clark, St. Clair, Michigan.

Claim.—"The arrangement of the saw, separating plate, deflecting or guide plates, and feed rollers."

6. For an *Improvement in Brick Machines;* Alex. H. Brown, Washington, D. C.

Claim.—"1st, The combination of the outside plungers with the skeleton wheel, inside plunger, and moulds. 2d, Discharging the bricks by means of the ratchet stock, vertical bars, and inside plungers. 3d, The mode of regulating the amount of feed, through the action of the quadrants upon the inside plungers. 4th, Regulating the movement of the skeleton wheel upon the lower plunger."

7. For an *Improved Arrangement of two Beam Engines with Parallel Shafts;* Thos Doyle, City of New York.

Claim.—"The arrangement of two beam engines, in line with their cylinders, contiguous to each other, and the connexion of the piston ends of the beams, by an intermediate beam."

8. For an *Improvement in Automatic Lubricators for Railroad Axles;* Michael Egan, Ogdensburgh, N. Y.

Claim.—"The arm placed under the bearing, and made to descend into the grease and rise to the journal at each revolution of the axle, by being connected to the eccentric, or its equivalent."

9. For an *Improvement in Knitting Machines;* Arasmus French, Waterbury, Conn.

Claim.—"1st, The combination of the eye pointed needle, with the hoop. 2d, The method of opening and closing the clamps, for holding the hoops, by the use of the cams or wedges on the circle, when worked by the same eccentric which works the needle. 3d, The method of narrowing by giving a longitudinal motion to the arch bar."

10. For an *Improvement in Washing Machines;* Daniel Haldeman, Morgantown, Va.

Claim.—"The combination of the hinged arms, crank shaft, restraining hooks, and rubbing board, for the purpose of holding and operating said rubbing board in its proper position whilst washing, and to enable the operator to raise it out of the machine, to remove or replace the clothes, by simply throwing back the restraining hooks, and drawing the shaft (still pivoted to the arms) towards the end of the machine."

11. For an *Improvement in Self-Acting Mules;* John Harris, Lawrence, Mass.

Claim.—"The peculiar combination applied to the endless chain, and for effecting such variable movement, or "running in" of the carriage; the same consisting of the driving shaft, the clutch apparatus thereof, the barrel gear, the eccentric gear, and mechanism connecting the latter with the shaft of the endless chain, to the mechanism for producing regular movement of the chain in a reverse direction."

12. For an *Improvement in Locks;* D. W. G. Humphrey, Gray, Maine.

Claim.—"The indicator, movable ward plate, and lever."

13. For an *Improvement in Gas Holders;* Stephen Hill and William J. Wood, Rochester, N. Y.

Claim.—"The combination of the pipes, with the diaphragm within the gas holder, for the purpose of applying an equable pressure to fill the gas holder with gas, and to expel the gas therefrom."

14. For a *Saw-Horse;* Horace Lane, Windsor, Vermont.

Claim.—"The use of the spur to hold the wood or timber in its place on the same horse, while the sawyer is sawing wood or timber into fire wood, or into short pieces. Also, the use of the roller, the ratchet wheel, the lever, the dog and spring, the cord, the pulley wheel, the slide, the arbor, and the groove and spiral spring, combined with the saw-horse."

15. For an *Improvement in Machines for Splitting Leather;* Jeremiah A. Marden, Newburyport, Mass., and Henry A. Butters, Haverhille, Massachusetts.

Claim.—"Combining with the feeding apparatus or mechanism, by which the leather may be restrained in its delivery, so as to effect the reduction of "cockles."

16. For an *Improved Cutter Head for Rotary Planes;* William Nixon, Adrian, Mich.

Claim.—"1st, The double bevel of the cutter, in combination with the bevel on that part of the stock or cylinder, which is in front of the cutter, so that the stock may act as a cap iron to the cutter, and to clear the shavings."

17. For an *Improved Composition for Kindling Fires;* Bernard O'Reilly, City of New York.

Claim.—"The fire lighting compound, formed by the admixture of the several ingredients, in about the proportions set forth."

18. For a *Mortising Machine;* Loomis E. Payne and Orris Pier, Stowe, Vermont.

Claim.—"A double semicircular mortise bit, or gauge, arranged so as to clear itself thoroughly in its action, and this, in combination with the double eccentric plate, to regulate the motion to and fro of said mortise bit."

19. For an *Improvement in Chain Locker Pipes;* Charles Perley, City of N. Y.

Claim.—"The locking piece applied to the chain locker pipe, and in combination with said locking piece and flanches, I claim the cover G."

20. For an *Improvement in Steam Boilers;* Henry N. Pettengill, Rockford, Illinois.

Claim.—"The arrangement of the flues, the water chambers and projections, with the feed water pipes combined."

21. For an *Improvement in Marble Sawing Machines;* Robert G. Pine, Newark, N.J.

Claim.—"The frame, connected by jointed rods, to rods working in sockets, which are fitted loosely on rods."

22. For *Improvements in Rotary Steam Engines;* Elias Matteson, Dayton, N. Y. Walter M. Parris, Detroit, Vt., and Hervey Parris, Pawlet, Vermont.

Claim.—"1st, The cut-off crank and anti-friction roller, in combination with the ellipses and balance beam, when so constructed, as to alternately open and close the cut-off valves, for the purpose of effecting an adjustable cut-off. 2d, The air spring to steam wheels, when so constructed as to have direct influence on the steam piston, and by its reciprocal action to maintain a steady, even motion of the engine, when in unison with the cut-off."

23. For an *Improved Mode of Hanging Window Sashes;* J. W. Ross, Zanesville, O.

Claim.—"Attaching the straps to the sashes, said straps passing in reverse direction, around pulleys, on a shaft in the style of the casing, the pulley being attached permanently to the shaft, and the pulley placed loosely upon it, and the pulleys being connected and disconnected when desired, the pulley having a pulley attached to it, to which pulley an elastic band is attached, said band being also attached to the sash."

24. For an *Improvement in Clothes Clamps;* James Sadgebury, Philadelphia, Pa.

Claim.—"The grooved button, in connexion with the grooved protuberances."

25. For an *Improvement in Drilling and Boring Machines;* Samuel M. Shryock, Hopkinsville, Kentucky.

Claim.—"Supporting the rests by rack and pinion of shaft, and combining the same with movable and fixed pulleys, as that the rests may be moved upward with any required velocity, or be dropped from the drill, at the will of the operator, during the revolution of the boring shaft."

26. For an *Improvement in Arranging and Feeding Screw Blanks;* Elliot Savage, East Berlin, Conn.

Claim.—"The combination of the reciprocating slider, the receiver or hopper, and the inclined conductor. Also, combining the spring pressure with the slider and hopper, and so as to cause the slide to operate laterally, with respect to the screw blank."

27. For an *Improvement in Sewing Machines;* Isaac M. Singer, City of New York.

Claim.—"The employment of the two eye-pointed needles, carrying its appropriate thread, and two working in unison, in combination with a shuttle, or equivalent therefor, to effect the concatenation of the two sets of stitches."

28. For a *Self-Feeding Atmospheric Lubricator;* John Sutton, City of New York.

Claim.—"An arrangement of means constructed on or within the cap or cover, (of the reservoir containing the oil, or other lubricating material,) sufficiently distant from oil to never be in contact with the same; by the adjusting of which, the passage or passages leading from the reservoir to the atmosphere, may be entirely or partially opened or closed at will, thus causing an increase or decrease of the feeding of the oil to the part receiving lubrication. When properly adjusted, the dome may be firmly secured down, when nothing can interfere with the regulating part."

29. For an *Improvement in Door Springs;* Amos Westcott, Syracuse, N. Y.

Claim.—"Adjusting the jointed lever, and also adjusting the pulley."

30. For a *Sofa Life Boat;* Peter Van Zile, Searles M. Griffin, and J. W. S. Dey, City of New York.

Claim.—"The structure, consisting of two buoyant parts, so constructed, that when separate, they shall each form a settee or sofa, and when united, a life boat."

31. For a *Chimney Cap;* John W. Davies, Richmond, Virginia.

Claim.—"The combination of the cap and the cone, with the tubes."

NOVEMBER 13.

32. For an *Improved Marble Sawing Machine;* George W. Bishop, Brooklyn, N. Y.

Claim.—"Operating the saws of stone sawing machines, by placing the lever on a tube, which has an internal screw thread cut in it, and is fitted on a screw rod, whereby the lever may, by turning the tube, be raised or lowered, to suit the height of the sashes."

33. For an *Improvement in Hanging Window Sashes;* Michael Bomberger, Hummelstown, Pennsylvania.

Claim.—"The application to window frames in which ropes and pulleys are used to support the sash, of the piece called the "rope hider," using for the purpose of concealing from view the ropes and pulleys, a strip of wood, or piece of any other material which will produce the intended effect."

34. For an *Improvement in Upsetting Tire, &c.;* Hiram Abbot, Wakeman, Ohio.

Claim.—"The arrangement of the parts of my machine, to wit: the bed plate, the adjustable jaws, (operated upon by the eccentric levers and spiral springs,) the eccentric levers, the elongated jaws, (which form the slot by being inserted, or diminished in width, through the agency of the eccentric lever and the spiral springs,) the levers and the eccentric lever."

35. For a *Weighing Attachment for Faucets;* Job Brown, Lawn Ridge, Illinois.

Claim.—"Attaching or connecting the frame to the scale beam, by means of the pulley resting upon the spout end of the beam, and attaching a cord to the platform of the frame, and the gate or spigot of a faucet of the vessel."

36. For an *Improved Marble Sawing Machine;* William C. Chipman, Sandwich, Massachusetts.

Claim.—"The rollers."

37. For an *Improvement in Attaching Shafts to Axles;* Thomas Chope, Detroit, Mich.

Claim.—"Attaching the shafts to the front axle, by means of the curved plates attached to the back ends of the shafts and the cylinder, secured in the ends of the projections which are attached to the front axle, the cylinder having notches made in their peripheries to receive the lips on the ends of the plates."

38. For *Improved Devices for Partially Excluding Dust from Railroad Cars;* Virgil P. Corbett, City of New York.

Claim.—"1st, The employment of the valves on the ends of the chambers, when said valves are so constructed as to leave small exhaust passages when closed, between the bottom of the valves and the car, and so arranged that one of them, for instance, shall be open, while the other is closed, as the car travels in one direction, and vice versa, if traveling in an opposite direction. 2d, Having the mouth of the pipe elevated above the highest point of the escape passages, in combination with the construction, arrangement and operation of the valves and chamber."

39. For an *Improvement in Making Boring Implements;* Ransom Cook, Shelburne Falls, Massachusetts.

Claim.—"The method of forging and shaping the lips and heads of the particular kind of boring implements, by the successive stages of die stamping."

40. For an *Improvement in Seeding Machines;* E. Darwin Curtis, Mt. Morris, N. Y.

Claim.—"Providing the forked distributing tube, with a wedge-shaped flap valve, arranged in relation to the forks, as specified."

41. For an *Improvement in Ring and Gudgeons for Bottle Fastenings;* Jos. C. Day, Hackettstown, N. J.

Claim.—"1st, The construction of the hoop with two gudgeons thereon, one of which is made open, or divided in halves, and which, when in actual use, are brought together, thereby forming one gudgeon, which, with that on the opposite side, are the recipients of the gudgeon boxes. 2d, Securing the two half gudgeons together, and consequently, the collar to the bottle by means of one of the gudgeon boxes of the bail."

42. For an *Improvement in Supporting Jacks;* John Fouser, Philadelphia, Pa.

Claim.—"The lever with its sliding block, having any convenient number of recesses, in combination with the adjustable screw coupling, and its sliding block."

43. For an *Improved Marble Sawing Machine;* Luther B. Fisher, Branch County, Michigan.

Claim.—"Operating the frames of stone sawing machines, by means of the segments, in combination with braces, arms, and chains or straps."

44. For an *Improvement in Separating Pins;* Thaddeus Fowler, Waterbury, Conn.

Claim.—"The method of separating the imperfect from the perfect pins, by the use of an endless apron, having both a longitudinal and a lateral oscillating or rocking motion."

45. For an *Improvement in Rotary Engines;* John H. Hathaway, Millbury, Mass.

Claim.—"Moving the head by means of a radial arm, having its centre of motion corresponding to the centre of the shaft, so as to withdraw the head from the cylinder, before elevating it."

46. For a *Lathe Chuck;* Eli Horton, Windsor Locks, Conn.

Claim.—"In combination with the opening on the front plate, for the introduction of the solid jaws, the hub on the back plate, for closing said opening and retaining the jaws in their respective slots. I also claim the locating of the circular rack in the deep recess or groove formed between the flanches, which not only form a tight casing to protect it from chips, filings, &c., but also support it, as well as the shanks of the screw bolts."

47. For an *Improved Marble Sawing Machine;* George W. Hubbard, Middletown, Connecticut.

Claim.—"Constructing the adjustable guides and permanent guides of stone sawing machines."

48. For an *Improvement in Argand Gas Burners;* Charles H. Johnson, Boston, Massachusetts.

Claim.—"Making the distributor with a catch, lip, flanch, or spout extending around its bottom. Also, combining with the Argand burner, a conical deflector, or the cone and its interior rod and bulb, the same being arranged in the middle of the air chamber of the burner."

49. For an *Improvement in Tobacco Presses;* Rudolphus Kinsley, Lynchburgh, Va.

Claim.—"The construction and employment of a press bar, or compresser, in which the article to be compressed can be put and placed under the press, and when compressed can be retained in that position and removed from the press till set, while the press is liberated for the operation."

50. For an *Improved Marble Sawing Machine;* William B. Kimball, Peterboro', New Hampshire.

Claim.—"Driving the saw frames or gates by means of the jointed pitmans and bar, in combination with the geared segment and crank."

51. For a *Water Metre;* Samuel Krauser and Christian Ritter, Reading, Pa.

Claim.—"1st, Measuring or indicating the passage of a quantity of water through a pipe, by allowing a small graduated portion thereof to escape and waste into a measuring and retaining receiver, or other vessel employed for that purpose. Also, in combination with the rod and plug, the spring and adjusting screws, for the purpose of regulating the passage of the water through and into the metre. Also, the drip, in rear of the plug, to cause the water from the slot to drop into the funnel, and thence into the receiver. Also, the inclined angular recesses on each side of the slot, on the inner face of the plate, for the purpose of carrying away from the slot any impurity or solid matter in the water."

52. For a *Self-Feathering Adjusting Tide Wheel;* Richard L. Nelson, Ocala, Florida.

Claim.—"The arrangement of the floating cam, and the floating self-feathering blades, or buckets, when said cam and blades are made to rise and fall with the rise and fall of the steam or water that drives the wheel. Also, in combination with a tide or current water wheel, the self-acting water brake, for causing the variable force of the current to be applied to the regulating of the speed of the wheel."

53. For an *Improvement in Corn Planters;* Thomas R. Markillie, Winchester, Ill.

Claim.—"The reciprocating weighted markers, acting, to perform the double function of operating the planting apparatus and making the hills."

54. For an *Improvement in Giving Tension to the Endless Band of Throstle Frames;* Joseph Morse, Woonsocket, Rhode Island.

Claim.—"The arrangement of the endless band to run to and fro, between every one of the spindles and the drum, and around a pulley carried by a slide, which is movable on suitable guides, and has a weight attached to it by a cord, so arranged as to draw the said slide in the proper direction to produce tension on the band."

55. For an *Improvement in Machine for Cutting Boot and Shoe Uppers;* Jean Pierre Molliere, Lyons, France; patented in France, August 19, 1854.

Claim.—"The use of a large bed plate, pressed up against a resisting body, by steam or other equivalent power, by which a large number of different parts are cut out from a skin, by different cutters at the same time."

56. For an *Improvement in the Mode of Hanging Carriage Bodies;* Ansel W. Porter, Little Falls, New York.

Claim.—"The free roller connexion between the carriage body and the longitudinal levers, for permitting all shocks to be conveyed through the said levers to the springs, without direct action on the body."

57. For an *Improvement in Lasting and Applying Soles to Shoes;* Charles Rice, Boston, Mass., and Sylvanus H. Whorf, Roxbury, Massachusetts.

Claim.—"The holding clamp and last, as used together and in connexion with the pressing or puncturing mechanism or both, for the purpose of fixing soles to shoes, by cement."

58. For an *Improved Compound Projectile;* Sylvanus Sawyer, Fitchburg, Mass.

Claim.—"Combining with the but or flat rear end of the cylindro-conical iron shell, a layer of lead, or softer metal than that of which the body of the shell is composed, and united or not to a layer of such metal, extended around the sides of the shell; the same operating while the shell is being projected through the bore of a gun, by a discharge of the powder therein. Also, making the rear part of the shell tapering or conical, combining therewith a ring or annulus of lead, or its equivalent. Also, confining the explosive screw cap to the body of the shell, by means of a softer or yielding metal or casing, which, when the cap or shell strike an object, shall give way under the force of the blow, and let the cap down with force, so as to compress the percussion water, or priming in it, or on the main screw, stopper, or plug, and so as to create an explosion thereof."

59. For an *Improvement in Machines for Adding Numbers;* Nathaniel S. Saxton, Riverhead, New York.

Claim.—"The spiral scale of numbers, combined with the traversing gnoman."

60. For an *Improvement in Preparing Artificial Teeth;* Barclay A. Satterthwait, Lima, Ohio.

Claim.—"The improvement in making whole or half sets of artificial teeth, gums, and plates, entirely of porcelain, by modeling porcelain material around porcelain teeth, or mounting porcelain teeth on porcelain plates."

61. For an *Improvement in Refrigerators;* D. W. C. Sanford, Cincinnati, Ohio.

Claim.—"The arrangement for causing the perpetual rotation of the whole of the air contained within the refrigerating apartments, said arrangement consisting, when the refrigerator is closed, of an endless passage or chamber, the walls, shelves, and ice receptacle of which, are so placed and constructed, that the air is compelled to circulate through the entire apartment or apartments, and from which the water of the melting ice is discharged immediately from the refrigerator, instead of flowing between its walls."

62. For an *Improvement in Forming Heads on Bedstead Screws;* H. N. Sherman, Birmingham, Connecticut.

Claim.—"Giving the lavers, to which the dies are attached, three separate and distinct movements in succession; the first lateral movement causing the smaller parts of the dies at their inner ends, to grasp the end of the rod; the second and sliding movement causing the collar to be formed and the square partially formed; and the third lateral movement perfecting the square and completing the head. Also, the combination of the dies with the rod, the rod serving as a stop at the commencement of the operation, and also, serving subsequently as a plunger, to compress the metal forming the square snugly within the dies."

63. For an *Improved Mode of Securing Shafts to Axles;* Alfred E. Smith, Bronxville, New York.

Claim.—"Connecting the stems of the shafts or thills with the eye staples by means of a spring or springs, acting laterally against the faces of the eye staples."

64. For an *Improvement in Processes for Making Zinc White;* Samuel Wetherill, Bethlehem, Pennsylvania.

Claim.—"The process of producing the white oxide of zinc from the ore of that metal, by the direct application of the fuel to the ore, in the crushed state, and in admixture therewith, in combination with a blast of atmospheric air, introduced in numerous small jets, to the charge of mixed ore and coal, in a thin layer."

65. For an *Improved Marble Sawing Machine;* Charles F. Warren, Malden, Mass.

Claim.—"Giving the saws a lateral vibrating movement in the saw frame, as the saw frame and saws work longitudinally by means of the rack, pinions, grooved sectors, and racks."

66 For an *Improvement in Straw Cutters;* Loren J. Wicks, Paterson, N. J.

Claim.—"Hanging the knife to a crank shaft and to a pivoted pitman, for the purpose of giving the curvilinear motion."

67. For an *Improvement in Planing Machines;* James A. Woodbury, Winchester, Massachusetts.

Claim.—"Making both of the edge cutters adjustable, in such manner, that the board can be fed in from either side of the machine, double guides being provided for the purpose."

68. For *Improved Machinery for Raising Ice from Rivers, &c.;* Cornelius R. Wortendyke, City of New York.

Claim.—"The method of adapting the ice elevating chain, to work under changes in the level of the water, by jointing the frame, carrying the lower wheel of said elevating chain to the lower end of the fixed incline, and sustaining the said frame work, wheel and chain on scows or floats. Also, the movable bottom, fitted and arranged to pass the ice from the movable to the stationary part of the incline. Also, in combination with the frame work jointed to the lower end of the fixed incline, carrying the lower wheel of the elevating chain, the adjustable slide journal boxes and screws, for regulating the tension of said elevating chain, as the water rises or falls."

69. For an *Improved Road Scraper;* Reuben W. Oliver, Assignor to self and Horace Hoyt, East Aurora, New York.

Claim.—"Supporting the forward end of the scraper, upon levers which rest upon the wheel, or their equivalent, as a fulcrum, and extending back of the scraper, for the purpose of operating conveniently, the back end of the scraper resting upon a fixed support. 2d, Hanging the bottom of the scraper to the sides. 3d, Securing the return of bottom to the position for loading by the chains, or their equivalent, attached to the said bottom and to the levers."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

United States Mail Steamer Arago. By Erasmus W. Smith, Resident Engineer to the "New York and Havre Steam Ship Company."

Vessel built by Jacob A. Westervell & Sons, under the superintendence of Captain William Skiddy. Engines, by Stillman, Allen & Co.

Dimensions.—

Length on deck,		292 feet.	
Breadth of beam,		40 "	8 inches.
" over all,		67 "	6 "
Depth of hold,		31 "	6 "
Tonnage, custom house,	2260.		
" carpenters' measurement,	3200.		
Diameter of cylinders,			65 inches.
Length of stroke,		10 feet.	
Diameter of Paddle wheels,		33 "	
Width of paddles,			20 "
Length "		10 "	
Shafts, of wrought iron,			
Diameter of crank journal,			19 inches.

Boilers—Two iron flue—one forward and the other aft the engines—

Each affording for fire and heating surface,	4000 sq. feet.		
Total amount of grate surface,	650 "		
Boiler shells back of furnaces.			
Diameter of cylinders,		14 feet	6 inches.
" " steam chimneys,		7 "	6 "
Each boiler has 6 furnaces in two tiers.			
Average length of grates,		6 "	6 "

Remarks.—The *Arago* has three decks, the upper or spar deck being but little encumbered by houses of any kind. The galley, dining saloon, ice houses, &c., being on the berth deck below, gives the spar deck an unusually plain, roomy, sea-worthy character. The materials employed in her construction are of the best description. The floor timbers are of oak, sided 15 inches, and joined accurately together, forming a solid mass of timber from end to end of ship, and extending transversely to turn of bilge. Frames, strengthened by diagonal iron truss work, composed of bars 5 inches wide, ⅞-inch thick, cross-laid at angles of 45°, riveted together at their intersections with each other and each bar bolted to every frame it crosses. The truss work is applied to inside of frames, one-half the bars being countersunk flush into frames, the remaining overlapping half recessed into ceiling.

"Captain Lines has devoted his whole time to supervising the details throughout the ship, which are probably as complete and as commodious and comfortable as any yet fitted in this country. Commencing on the spar or upper deck, forward, are seen Brown's patent anchor gearing, stated to be the most efficient apparatus for working cables and anchors at present known, combining strength, security, and great saving of room and labor. It was put in operation during the trial trip, at Sandy Hook, when the anchor was weighed with the greatest ease. From the foremast, going aft, are several covered stairways, leading down to the different cabins, with large skylights. By the mainmast is a house, protecting the main stairway, containing cushioned seats for passengers—abaft this is a range of large skylights and one of Brown's patent capstans; on the after part of this deck (300 feet long) is a circular house protecting the helmsman, with a stairway to the dining saloon, a state room for the captain and one for the first officer. In the centre is a sitting room, from which is entered by folding doors a convenient smoking room, containing card tables, and a private passage on each side to the water closets. This whole deck is enclosed with strong locust stauncheons and rail, and a galvanized iron netting, imparting a very light and airy appearance. On the outside are suspended eight large life boats (Francis's patent,) fixed with oars, sails, and water casks, &c.

"On the main deck, commencing and descending by the stairway aft, you enter the dining saloon, 100 feet long, with open galleries amidships, enclosed by a handsome polished railing, over which, on the spar deck, are the large skylights, imparting light and air through these galleries down on to the next deck, with beautiful effect. A double range of hard wood polished tables, with cushioned seats, covered with crimson plush, extend the whole length of the saloon. Over these tables suspended are shelves or racks, containing the different cut glass and bottles required at table. Over each table is also suspended a beautiful French carcel lamp. The bulkheads on either side of the saloon are all of the most recherche woods, assorted and highly polished. They are intersected by alcoves with circular arches, leading to a suite of state rooms communicating with each other. Each alcove has a large light opening through the side of the ship; also, one in each state room. These rooms each accommodate two persons with berths, sofa, and toilet fixtures. Advancing forward, you pass the mainmast and stairway. On the right you enter the ladies' saloon, tastefully decorated with table, cushioned seats, and mirrors. This opens into a private boudoir or dressing room, adjoining which are three water closets and a bath room. Opposite the ladies' saloon is the captain's room, conveniently and tastefully fitted up. Adjoining, going forward, you enter the steward's pantry, containing bar room, steam table, plated ware, and cases for silver, &c., &c., beautifully arranged, under the direction of Mr. Allen, chief steward. Continuing on from the ladies' saloon, through an extensive and well lighted passage, leading forward 150 feet, are placed the ice and vegetable houses, between the side of the ship and between the paddle or guard beams, where, in all steamers, it is usually damp. These houses are entirely out of sight, and communicate with the upper deck. Beyond this the place is occupied with state rooms and alcoves, lighted and arranged similarly to those already described aft. At the extreme end, forward, is a ladies' boudoir and water closet. On the left side of this passage are the engineer's room, state rooms, barber's dressing room, and a half circular stairs leading to the upper deck. Crossing by an alcove to the port side, a similar half circular stairway from the upper deck, conducts to the forward cabin passengers' dining saloon, well lighted and ventilated, and fitted up with Thompson's patent life tables, and all other conveniences similar to the after saloon and pantry. Several state rooms extend forward of this saloon to the store-room and forcastle. Proceeding aft through a passage, either side is occupied with rooms for officers, servants, mess rooms, galleys, ice houses, lamp room, butcher's and baker's rooms, and large cabin galley, and steward's pantry.

"On the berth deck, under the main deck, is seventy feet long, lighted and aired by the galleries and skylights already described. The longitudinal bulkheads are delicately ornamented and beautifully grained in oak, having side sofas, covered with crimson plush. Alcoves intersect every 12 feet, leading into the different state rooms, all of which are well lighted and ventilated; in each room are two berths, sofa, and toilet fixtures, &c., similar to those above. Rooms communicate where required by families. Beyond the forward stairway, leading up to the dining saloon, are rooms for servants, stores, luggage, &c.; between this and forward lower cabin, the space is occupied with engines, coal, &c.; after this, descending by a stair-way, between the two half circular stairs forward, you land in a similar saloon or passage to that in the lower cabin aft, with alcoves leading to state rooms. There are water closets on each deck, all ventilated on a new plan, with Perley's patent ventilators.

"The ship is thoroughly ventilated on the outside with Perley's patent ventilators, between every frame, thus allowing free circulation to the floor timbers.

"The *Arago* can accommodate, comfortably, 250 passengers, and carry about 900 tons of cargo, besides 900 tons of coal. Her draft, with all on board, is 17 feet 4 inches."

The painful experiences of the past have not been forgotten. Most judicious means have been adopted to prevent the sinking of the ship, and also, for pumping water and extinguishing fire. The engines and boilers are enclosed in a tight compartment composed of longitudinal and transverse bulkheads of two thicknesses of two inch plank cross laid. Other transverse bulkheads divide the ship forward into several sections. The coal bunkers are on either side of ship, opposite engines and boilers, and between side of ship and longitudinal bulkheads. The bunkers communicate through doorways rimmed with iron and fitted with iron slide gates, which can be closed in case of disaster at sea. The advantages of such an arrangement in case of collisions with vessels, rocks, or iceburgs is incalculable.

The engine department is fitted with two very large fire and wrecking pumps, each operated by a separate steam cylinder, and capable of delivering 700 gallons of water per minute. They are three times the size commonly used on steamships, and got up expressly for the *Arago* by the builders of the engines. They are provided with a small independent boiler for working in port, but at sea are connected with the main boilers.

The arrangement of engines is peculiar, and the first of the kind. The cylinders stand nearly opposite each other fore and aft, inclining, when on their centres, towards a vertical line through centre of shaft, an angle of 24°. The usual centre-shaft, centre-shaft cranks, and centre-shaft pillow blocks, are dispensed with, the arrangement affording means of connecting the engines at right angles by means of a simple union link, which is made of wrought iron and forged in one piece. As the link suffers only a tensile strain, it is considered safer than a centre-shaft which suffers both a torsional and transverse strain. The performance of the union link for two voyages is highly satisfactory. The steam and exhaust valves are of the usual double beat balance description; the valve chambers, induction and eduction pipes, are cast with the cylinder, thereby affording a very short and direct connexion therewith. The rock shaft and valve gear combine the latest improvements, and are fitted with "Allens & Wells'" variable cut-off, which is adjustable for cutting off at different points of the stroke by the hand of the engineer while the engine is in motion. Each engine is provided with "Pirsson's" patent surface condenser, supplying 2000 square feet of condensing surface. Tubes, of copper, one inch diameter.

Until late years, the oscillating engine was not considered so well adapted for ocean steam ships as the side lever, beam, and other stationary cylinder engines, extensively made in this country and Europe. The oscillators were considerably used in the latter place, but on comparatively a small scale, when they were invariably fitted with the slide, steam, and exhaust valve, and if a separate expansion valve was introduced, it was generally the old fashioned swing-valve, inserted in the steam pipe *outside* the cylinder trunnion, which necessarily occasioned a great loss in the expansion of steam. Thus arranged, it could not compete in service for an equal amount of fuel, with similar size, stationary cylinder engines, having better valve arrangements.

To American engineers, and chiefly to Horatio Allen, Esq., of the house of Stillman, Allen & Co., belongs the credit of modifying and improving the oscillating engine, until it now combines the same fuel saving appendages adapted to the best stationary cylinder marine engines, while its efficiency in other respects is unimpaired, and it may be considered a successful competitor with the side-lever and other popular forms of engines.

American engineers can also take to themselves the credit of having led the way in building the *largest* oscillating engines. Stillman, Allen & Co., in 1851, built a pair of oscillators for the steam ship "*Golden Gate*," of 85 inches diameter of cylinder, and a stroke of 9 feet. In 1852, they constructed a single oscillator for the "*John L. Stevens*," of 85 inch cylinder, 9 feet stroke; and the following year, one for the "*Augusta*," of 85 inch cylinder, 8 feet stroke; then followed the "*Knoxville*" and the "*Arago*," by the same builders.

When it is considered that in the arrangement of the "*Arago*," when compared with side-lever double engines similar to those of the "Collins" and "Cunard" steamers, two steam cylinder cross-heads, four cylinder side connecting links, four side levers, four cross-tail links, two connecting rod cross-tails, two connecting rods, two centre-shaft cranks, one centre shaft, two centre-shaft pillow-blocks, in all *twenty-three parts* of what may be considered the *harness* between the power and resistance are dispensed with, and the piston-rod attached directly to the crank-pin; some idea of its simplicity may be conceived. The risk of breaking any *one* of the above enumerated twenty-three parts, which would disable the engine, is avoided. The union link, substituted to connect wheel-cranks in place of centre-shaft, is the only part *added* between the piston rod and paddle wheels, and is so simple of construction as to create no fears of its frailty.

The cylinder trunnion, which some eminent engineers have considered a questionable feature of the oscillating engine, have invariably worked well, and I believe that none of the American engines have given difficulty from that source, there being no beam in the arrangement through which the power is transmitted, the pressure on the cylinder trunnions is only one-half what it would be on beam centre journals; the bearing surface of the trunnion journals must necessarily be large to give sufficient capacity of steam and exhaust opening; and, moreover, the current of steam constantly passing through the trunnions when the engine is in motion, tends to keep them at a temperature corresponding with that of the circulating steam and prevent them from accumulating heat of a higher degree.

Abstract of "Arago's Log" on first Outward Passage.

June, 1855.	Distance.	Revolutions.	Average steam.	Tons coal, (anthracite.)
	Miles.		lbs.	
3	190	15,144	30	37
4	215	15,064	30	41
5	228	17,708	30	44
6	252	19,716	30	49
7	268	19,564	30	50
8	276	19,807	30	46
9	243	20,905	30	47
10	260	20,346	25	47
11	270	21,055	30	47
12	250	20,107	22	44
13	278	21,115	25	45
14	294	22,620	25	47
15	120			
	3144			

Stopped off Cowes, 10 P. M.; deduct 4 degrees 50 minutes for difference in time, and 5 degrees 10 minutes for stoppages and slowing, leaves 12 days passage.

Homeward Passage from Cowes.

July, 1855.	Distance.	Revolutions.	Average steam.	Tons coal.
	Miles.		lbs.	
5	125	18,198	26	36¼
6	268	20,827	30	45¼
7	268	21,693	32	42½
8	248	20,867	30	50½
9	270	21,756	30	54¼
10	250	21,059	30	53
11	198	19,345	25	52
12	273	22,648	30	53
13	282	23,735	30	49¼
14	288	23,372	30	45
15	304	23,645	30	45

The accompanying illustration (Plate V.,) exhibits the style of rig, and is a correct likeness of the ship.

For the Journal of the Franklin Institute.

Remarks on Calculating Machines.

The October number of the *London Practical Mechanics' Journal*, in an article on the Paris Exhibition, notices a calculating machine by Scheutz, of which it explains the movement thus—

"Supposing it is desired to work out the cubes of the numbers 1, 2, 3, 4, &c.—as simple a case as can perhaps be taken—let us set down a few of these cubes, thus:—

1		8		27		64		125
	7		19		37		61	
		12		18		24		
			6		6			

"In the second row, and below the spaces of the terms above, place the differences between those terms. In the third and fourth rows similarly place the differences between the terms of the second and third rows respectively. We find that the terms of the fourth row are all sixes (and this will be the case, however many terms we set down in the first row.) From this we derive a rule for obtaining the cubes by the repeated addition of the constant number 6. In working out this simple calculation in the machine, four horizontal rows of wheels will be called into play, the top row representing the products. At starting, the second row will be set to indicate 1, and the fourth, 6, whilst the first and third rows will show zeros, as at A.

0	1	1	8	8	27	27	64
1	1	7	7	19	19	37	37
0	6	6	12	12	18	18	24
6	6	6	6	6	6	6	6
A	B	C	D	E	F	G	H

"At the first movement of the machine, the amounts indicated by the second and fourth rows are added respectively to the first and third, as at B, the top one indicating the cube of 1. At the next movement, the number indicated by the third row is added to the one immediately above, as at C. It requires two movements, however, to complete a stroke or calculation of the machine, as every number indicated must be added to that above it, the alternate ones being operated upon at each movement. Thus, at the next movement, the second and fourth numbers are added to the first and third, as at D, making the top figure 8—the cube of 2. Two more movements produced the alterations shown at E and F, the latter showing the cube of 3, and the changes G and H show the cube of 4. Proceeding in this way, each couple of movements produces the cube of a number differing from the last by one. All regular series can be calculated in this manner, as can all tables the terms of which, when treated as above, show a constant difference after a less or greater number of operations."

It is curious that figures may be raised to any power by a similar process to the above, and the rule to ascertain the number of movements required and the constant difference for any exponent is as follows:—

Power.	Movements.		Constant difference at last movement.
Square or 2d,	2	×1	= 2
Cube or 3d,	3	×2	= 6
" 4th,	4	×3×2	= 24
" 5th,	5	×4×3×2	= 120
" 6th,	6	×5×4×3×2	= 720
" 7th,	7	×6×5×4×3×2	= 5,040
" 8th,	8	×7×6×5×4×3×2	= 40,320
" 9th,	9	×8×7×6×5×4×3×2	=362,880 &c., &c.

Practically this would complicate a calculation, although it is obvious that in the calculating machine referred to, any power could readily be indicated. It is, however, a curious property of numbers.

I annex an example for 5th power; the 5th power of

		1		2		3		4		5		6		7		
	is	1		32		243		1024		3125		7776		16807		
difference	is		31·		211·		781·		2101·		4651·		9021·		1st	movement.
"	"			180·		570·		1320·		2550·		4380·			2d	"
"	"				390·		750·		1230·		1830·				3d	"
"	"					360·		480·		600·					4th	"
"	"						120·		120·						5th	"

J. V. M.

Nasmyth's Improved Process of Puddling Iron.

To the Editor of the Journal of the Franklin Institute.

The announcement made in the September number of the *Journal*, p. 209, under the above caption, that we were assignees of the patent for the United States, was an error which has arisen probably from the fact that we had, in Mr. Nasmyth's name, applied for such a patent in this country.

Mr. Nasmyth's claim has, however, been rejected by the Patent Office, on the ground that it conflicts with the patent issued to Guest and Evans by the English Patent Office, in 1840, and described in the *London Repertory of Patent Inventions*, Vol. xvi, p. 341, by reference to which, it will be perceived that the principle of both possess, viz., the application of steam beneath the surface of the molten metal, is the same, although in our judgment, Mr. Nasmyth's application is far more simple and less likely to derangement than the former, and perhaps these advantages may be all that is required to bring the process into general use. Be that as it may, we take occasion to say that Mr. N's. accounts of his success in England in producing by this method a cheaper and better iron, are such as to warrant us in expressing the hope that some of the leading iron firms in this country may take it up.

MERRICK & SONS.

Philadelphia, November 15, 1855.

For the Journal of the Franklin Institute.

Remarks on the Steamer "Lancefield."

HONG KONG, CHINA, August 4th, 1855.

To the Editor of the Franklin Institute Journal.

A new Steamer called the "*Lancefield*," arrived on this station about a month since from England. She is owned by the House of Jardine, Matheson & Co., of Hong Kong, and runs between Bombay or Calcutta and this place in the opium trade. I visited her a number of days since, when I obtained the following information, which I transmit to you, as I suppose you take an interest in all that is transpiring in our profession, even in this remote region.

She has two engines—constructed by Napier & Sons of Glasgow—of the four piston rod variety, connected direct, *i. e.* without the inter-

ention of gearing to the screw shaft, with trunk air-pumps as her engi-
eer called them, but which are simply plunger pumps; the plungers
orking through stuffing boxes in each end of the pump; and the differ-
nce in the areas of the back and front end of the plunger is that which
effective in pumping off the air and water. The cylinders, 52 inches
diameter, by 3 feet stroke of piston, each, are set horizontally, side by
ide, on one side of the shaft, and the air-pumps in a similar manner on
e opposite side. The piston rods, passing above and below the shaft,
re connected direct to the air pump plunger, which being hollow, the
nain connecting rod is connected from the crank-pin to the bottom of the
arge end of it, in the same manner that the connecting rod of a trunk
ngine is connected to its trunk.

The small end of the plunger, which works through the back end of
e pump, serves no other purpose than that of a guide, which becomes
ecessary as the main connexion of the engine is attached to this plunger.
y this arrangement it will be seen, that the air-pump plunger has the
ame stroke as the steam piston, and makes the same number of strokes
r any unit of time, which gives it a higher velocity than is usual or de-
irable in marine engines; but the engineer of this steamer informed me
hat he discovered no difficulty in the working of the pumps up to the
aximum speed of the engines, viz: 62 revolutions per minute, the foot
nd inboard delivery valves consisting of a series of small circular india
ubber valves, six inches in diameter by half an inch thick. The air-pump
nd condenser are cast in one piece, the condenser consisting of a rec-
angular box, fitted with a large number of man-holes for the purpose of
learing out the core at the time of casting, with the pump inside. The
nds of the condensers are faced and bolted together; and the whole
lan thus forms a more compact and substantial arrangement than any
ther type of propeller engines I have seen.

The only objection that I can notice to it as far as the engines are con-
erned, is the exceedingly high temperature of the engine room, which
ecessarily ensues from the fact of its being directly over the cylinders;
ut in this instance, much of the heat is avoided by a judicious arrange-
ent of wind sails. Her propeller consists of a three bladed true screw,
4 feet 6 inches in diameter by 28 feet pitch, overhung, *i. e.*, the shaft
as no bearing in the outer stern post.

She has four tubular boilers; two in one shell, with furnaces at each end,
iffering only from those of most of the English steamers in these waters
y being set end to end in a fore and aft direction in the centre of the
ip, instead of side by side athwartships. The coal bunkers are on either
de of the boilers, and so arranged that the coal runs down of its own
ravity to the furnace doors, avoiding the necessity of trimming it; but
otwithstanding this advantage, they have employed on board that vessel
rty-eight firemen and coal-heavers, more than the United States Steam
rigate *Powhatan* is allowed, a ship of 2500 tons burden. No one, I
ppose, who has given the subject any attention, and whose opinion is
orth obtaining, will deny that the engine department of the steamers
f our navy are insufficiently manned, or if there be such a one, I would
commend him to take a cruise in the China Seas in one of our
rst class steam Frigates, during which I am very much inclined to think

he will collect sufficient evidence to occasion quite a change to come over the spirit of his dream. Any merchant steamer on this station is proportionally better manned in the engine department than the "*Powhatan*," and but few of them do more running. But I am digressing. I sat down to write about the "*Lancefield.*"

To resume. The cylinders are fitted each with a locomotive slide valve, which cut off the steam at one-third from the termination of the stroke. They were formerly fitted also with slide cut-off valves, but they did not work well, and the engineer has now dispensed with them as a useless appendage, preferring the use of the throttle valve and the consequent loss of steam by wire drawing, when a reduction of speed becomes necessary.

With the maximum speed of 62 revolutions per minute, in smooth water, under steam alone, I am informed she obtains a speed of fifteen knots the hour; but as this only gives the propeller, allowing 6082⅔ feet to the knot, 12·3 per cent. slip, I fancy she does not make as much as that; but as she is a vessel of excellent model, very fine lines, and considerable length, comparatively with breadth of beam, I think that under favorable circumstances, her bottom and propeller blades being free from barnacles, shells, &c., that very rapidly form on iron vessels running in salt water, 20 per cent. would be a fair allowance for slip, which would give her a maximum speed of 13·7 knots per hour. This speed is obtained by the consumption of 45 tons of coal per diem. The data that I obtained relative to the performances of the boilers, &c., I do not consider sufficient of reliance upon which to base any calculations either of their evaporative powers, or the horses power developed by the engines, more particularly as I am in possession of no indicator diagrams showing the true point of cutting-off with the pressure of steam on the piston for any particular period. K.

For the Journal of the Franklin Institute.

Is there Native Iron in Africa? By Robert F. Brower, M. D., Secretary of the American Iron Association.

Not a little interest has been felt in relation to an alleged discovery of native iron in the interior of Africa. Nearly all our journals have published some general statements that have been made in respect to it, coupled with names of practical analysts; on which account we have waited with some hope that we should have, fully recorded, all the particulars of such an interesting and anomalous discovery. As we have not been satisfied by any explanations, we take the liberty to declare our opinion of the improbability of any such discovery, with the reasons for our conclusions. Inasmuch as we have had similar representations made concerning iron ores found in our own country, it is well that we should clearly understand how pure it is possible for iron to exist in its matrix —the soil or rocks.

Iron has a strong affinity for oxygen, to such an extent that it will decompose water, whether free or in union with soils or rocks. Most minerals contain water as a chemical constituent, and iron under the slow but sure operation of attraction will, where there is the least permeability of rocks, decompose it, drawing from it, even though at remote distance, its oxygen. Those elements which have the strongest affinities for each other, will unite when brought together, however long time is required. Whether we find iron in plutonic or secondary rocks, at whatever depth below the surface, it is invariably in the state of an oxide, if not combined with other elements. Such has been the universal experience of mining. Meteoric iron having been formed under different circumstances from any that present to us in or upon the earth, we cannot refer to it as conflicting with our statements.

Iron presents such a variety of interesting phenomena under various treatments, that it is very easy to be misled in theoretical conclusions, if we do not measure accurately the chemical forces at work. A smith may take a piece of the magnetic ore of Lake Champlain or New Jersey, or of the specular ore of Superior or Missouri, and by careful treatment in his smithery fire, will work out a knife blade from one end, while the other retains its original appearance. Again, he may take a piece of these ores, and in a moderate fire, allowing considerable time, will convert it into metallic iron, without altering materially its general outward appearance. That the smith and many others should conclude, therefore, that the ore was pure iron, is not at all strange. He does not know the influences of heat in driving off, or rather drawing off, its oxygen, to unite with a portion of the carbon of the fuel.

Iron under careful or moderate protection by artificial means may be preserved possibly for ages; but as a general rule it is steadily in process of union with oxygen and returns to earth. It is not reasonable, therefore, to expect to find virgin or native iron, unless it has been formed by some recent cause. Meteorolites are presumed to be ejected from volcanoes of our own or some other sphere. The only other conceivable circumstance under which pure iron might be formed in nature, is by the ejection of trap rock through pure iron ore lying contiguous to coal; but the great improbability of any such occurrence is at once evident to a geologist. The idea of such a possibility would not suggest itself, were it not stated that the alleged native iron was associated with zeolite. A crystallization often occurs in working iron ores which resembles zeolite, and possibly has the same composition. There are no facts presented in relation to the alleged native iron, disproving that the specimen was originally magnetic or specular oxide, or the spathic carbonate of iron, and had been converted in a smithery, under a slow fire, by which means, as it may often occur, there was no excess of carbon; on the contrary, crystals of magnetic oxide remained, with quartz and zeolite, a silicate of alumina, and lime or soda.

The following are the compositions of magnetic, specular, and spathic ores, which are the purest states in which iron is formed in the earth.

Magnetic iron ore ($Fe_3\ O_4$) contains in 100 parts
of iron, 72·4 parts by weight,
oxygen, 27·6 do. do.

affording 72·4 per cent. of iron by analysis, or about 65 per cent. in a smithery, or catalan forge fire, when carefully managed.

Specular iron ore ($Fe_2\ O_3$) contains in 100 parts
of iron, 70 parts by weight,
oxygen, 30 do. do.
affording 70 per cent. of iron by analysis, or about 63 per cent. in a smithery, or catalan forge fire.

Spathic iron ore ($Fe.\ O.\ C.\ O_2$) contains in 100 parts
of iron, 48·3 parts of iron,
carbon, 10·4 do. do.
oxygen, 41·3 do. do.
affording 48·3 per cent. of iron by analysis, or about 40 per cent. in a smithery, or catalan forge fire.

We should remark in respect to this last ore, that when first mined it is yellow, but in time turns to a dark brown color. This ore when roasted becomes the magnetic oxide of iron, the carbonic acid being driven off or decomposed. When found quite pure, it may be worked as the others, in a smithery, or catalan forge fire. Most probably this is the ore found in Africa, for the Rev. Aaron P. Davis, who sent the specimens to America, writes that "When he (Mr. George L. Seymour, who obtained it from the natives) brought it, it appeared like a craggy rock, of yellowish color on its surface, and with a very small exception, it could not be separated but by heat, and hard pounding with my largest sledge hammer, and a chisel prepared for the purpose." *Heat and hard pounding*, we know not for how long a time, have materially altered the character of the mineral.

When pure iron ore in small quantities is reduced in a smithery fire, it may be worked to any degree of excellence. We have not space to show the relative costs of reduction by various processes, or to set forth the relative value of the products. But it is evident to every one conversant with the nature of iron, that in small quantities, in a charcoal fire, it may be thoroughly worked to a superior quality, as by the natives of Africa, at a heavy cost of labor. A SMALL SPECIMEN OF IRON PREPARED EXPRESSLY FOR ANY CERTAIN PURPOSE, DOES NOT AFFORD A PROPER EVIDENCE OF THE QUALITY WHICH CAN BE MADE FOR THE MARKET, WITHIN THE MARKET VALUE.

We cannot reasonably leave this subject without alluding to what would be the expense of mining native iron, supposing it were found. Even the quotation from Mr. Davis's letter may satisfy our judgment, though there is stronger evidence that it could not be mined at a profit for our market. Native copper when found in masses, costs for mining several times the value of its weight of iron. Copper may be cut with chisels, but who would undertake to cut up solid or even porous masses of iron for its whole value? If there are any who desire the business, they may find in our country pretty extensive masses of iron taken from chilled furnaces, which the furnace masters would gladly have removed from their premises.

Since the above article was written, the writer has received specimens of the iron, and has examined several reports and accounts respecting the reputed discovery. He is fully confirmed in opinion that his views of the iron in question are correct; and that the specimens were "brought

to nature" in a smithery fire, from the spathic ore—the proto-carbonate of iron.

If there is an abundance of this ore, or of the others mentioned, in even a moderate degree of purity, found in Africa, and easy of access, it is far more valuable than a seam or deposit of massive native iron. Copper, in masses, may be cut up, and is then worth about $500 a ton. Crude irregular masses of iron would be worth not more than 20 to 25 dollars a ton.

An Account of some Experiments made with the Submarine Cable of the Mediterranean Electric Telegraph. By CHARLES WHEATSTONE, F.R.S.*

The following results were obtained between May 24 and June 8 in last year, with the telegraphic cable manufactured by Messrs. Kuper and Co. of East Greenwich, for the purpose of being laid across the Mediterranean Sea, from Spezia on the coast of Italy, to the island of Corsica. The manufacturers, in conjunction with Mr. Thompson, the engineer of the undertaking, kindly afforded me every facility in carrying on the experiments. The short time that elapsed between the opportunity presenting itself and the shipping of the cable for its destination, prevented me from determining with sufficient accuracy some points of importance, respecting which I was only able to make preliminary experiments, but the following, which I was able to effect with the means at hand, may possess sufficient interest to be made public. They present perhaps nothing theoretically new, but I am not aware that experimental verifications of some of these points have been made before. I assume that the reader is acquainted with the experiments of Dr. Faraday described in the *Philosophical Magazine*, Ser. 4, vol. vii, p. 197.

The cable was 110 miles in length, and contained six copper wires, one-sixteenth of an inch in diameter, each separately insulated in a covering of gutta percha one-tenth of an inch in thickness. The whole was surrounded by twelve thick iron wires twisted spirally around it, forming a complete metallic envelope one-third of an inch in thickness. A section of the cable presented the six wires arranged in a circle of half an inch diameter, and one-fifth of an inch from the internal surface of the iron envelope.

The cable was coiled in a dry well in the yard, and one of its ends was brought into the manufactory. The wires were numbered 1, 2, 3, 4, 5, 6, and the ends in the well were indicated by an accent; the ends 1′2, 2′3, 3′4, 4′5, 5′6 were connected by supplementary wires, so that the electric current might be passed in the same direction through all the six wires joined to a single length, or through any lesser number of them, the connexions being made at pleasure in the experimenting room.

The rheomotor employed was an insulated voltaic battery consisting of twelve troughs, each of twelve elements, which had been several weeks in action.

First Series.—The following experiments show that the iron envelope of the compound conductor gives rise to the same phenomena of induction which occur when the insulated wire is immersed in water, as in Dr. Faraday's experiments.

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* From the Lond., Edin., and Dub. Philos. Mag., July, 1855.

Exp. 1. One end of the entire length, 660 miles, was brought in connexion with one of the poles of the battery, the other end remaining insulated. The wire became charged with negative electricity when its end touched the zinc pole, and with positive electricity when it communicated with the copper pole. A current, indicated by a galvanometer placed near the battery, existed as long as the charge was going on, and ceased when it arrived at its maximum. [The feeble current attributed to imperfect insulation, which continues as long as the contact with the battery remains, is here left out of consideration.] When the wire was charged, and the discharge effected by a wire communicating with the earth, the current produced was in the same direction, whether the discharge was made near the battery or at the opposite end; *i. e.*, the current in both cases proceeded from the wire to the earth in the same direction.

Exp. 2. On bringing one end of the wire in contact with one of the poles of the battery, the other pole having no communication with the earth, the wire remained uncharged. A very slight and scarcely perceptible tremor was observed in the galvanometer needle interposed between the battery and the wire.

Exp. 3. To each of the poles of the battery was attached a wire 220 miles in length, and similar galvanometers were interposed between the two wires (the remote extremities of which remained insulated) and the battery. So long as one wire alone was connected with the battery no charge was communicated to it, but on connecting the other wire with the opposite pole both wires were instantaneously charged, as the strong deflection of both needles rendered evident. On bringing the free end of one of the wires in communication with the earth, it alone was discharged, the other wire remaining fully charged.

Second Series.—*Exp.* 4. One pole of the battery was connected with the earth, and the other with 660 miles of wire, which had an earth communication at its opposite end; three galvanometers were interposed in the course of the conductor; the first near the battery, the second in the middle of the wire, *i. e.*, 330 miles from each extremity, and the third at the remote end near the communication with the earth. When the connexion of the battery with the wire was completed, the galvanometers were successively acted upon in the order of their distances from the battery, as in the experiments recorded by Dr. Faraday. When the earth connexion at the remote extremity of the wire, on the contrary, was completed, the disturbance of equilibrium commenced at this end, and the galvanometers successively acted in the reverse order, *i. e.*, the galvanometer which was the most distant from the battery was the first impelled into motion. In the latter case, before the completion of the circuit, the needles of the galvanometers had assumed constant deflections to a limited extent, owing to a feeble current arising from the uniform dispersion of the static electricity along the wire.

Exp. 5. The two extremities of the 660 miles of wire were brought into connexion with the opposite poles of the battery. When one of the ends previously disconnected from the battery was united therewith, the galvanometers at the extremities of the wire, and consequently which were at equal distances from the poles of the battery, were immediately and simultaneously acted upon, while that which was in the middle of the wire was subsequently caused to move. When the wire disconnected in the middle instead of near one of the poles of the battery was again united, the middle galvanometer, which was the most remote from the battery, was the first acted upon, and those near the poles subsequently.

The comparison of the two above mentioned experiments shows that the earth must not be regarded simply as a conductor, which many suppose to be the case. Since, in the first experiment there were not many yards distance between the two earth terminations, did the extent of ground between them act only as a conductor, the two galvanometers at the extremities of the wire should have acted simultaneously, as in the second experiment, and as would have been the case had a short wire united the two extremities which proceeded to the earth.

Third Series.—Exp. 6. One pole of the battery was connected with the earth, and the opposite pole with one extremity of the 660 miles of wire, the other end remaining insulated; a delicate galvanometer was interposed near the battery. Notwithstanding there was no circuit formed, the needle showed a constant deflection of 33½°; the feeble current thus rendered evident is not so much to be attributed to imperfect insulation, as to the uniform and continual dispersion of the static electricity with which the wire is charged throughout its entire length, in the same manner as would take place in any other charged body placed in an insulating medium. The strength of the current thus occasioned appears to be nearly, if not exactly, proportional to the length of the wire added, as the following table will show: the first column indicates the number of miles of wire subjoined beyond the galvanometer, and the second the corresponding deflections of the needle:—

Miles.	°
0	0
110	6½
220	12
330	18
440	23½
550	28
660	31

Exp. 7. One end of the 660 miles of wire was now allowed to remain constantly in contact with one of the poles of the battery; but the galvanometer was successively shifted to different distances from the battery. The strength of the current was now shown to be inversely as the distance of the galvanometer from the battery, becoming null at its extremity, as shown in the following table. The first column shows the distance from the battery at which the galvanometer was placed, and the second column the corresponding deflection of the needle.

Miles.	°
Near the battery	33½
110	31
220	25
330	15
440	12
550	5
660	0

The deflections of the needle of the galvanometer employed in these experiments were, when they did not surpass 36°, very nearly comparable with the force of the current. This I ascertained in the following way. I took six cells of the small constant battery described in my paper "On new Instruments and Processes for determining the Constants of a Voltaic Circuit," printed in the Philosophical Transactions for 1843, and placed in the circuit formed of the 660 miles of wire, the earth, and the galvanometer, successively 1, 2, 3, 4, 5, and 6 cells. Leaving out of consideration the resistances in the cells themselves and in the earth, which were very inconsiderable in comparison with that in the long wire, the force of the current should be approximately proportionate to the number of the elements; and since the deflections of the needle nearly indicated this proportionality, as the following table will show, it may be assumed that the force of the current, when the deflection of the needle did not surpass 36°, nearly corresponded with the angular deviation.

Cell.	°	Cell.	°
1	6	4	28
2	14	5	32
3	19	6	36

From the preceding experiments (6 and 7,) it seems to result, that whatever length of wire is connected with the battery, if a galvanometer is placed at the farther extremity of the wire and a constant length added to the other termination of the galvanometer, its indication remains always nearly the same. Thus the galvanometer indicated 6½° when it was placed close to the battery and 110 miles of wire were subjoined beyond it; and 5° when 550 miles were interposed between the battery and galvanometer, the same length, 110 miles, being subjoined. In like manner, when 220 miles were added beyond the galvanometer placed near the battery, the indication was 12°; precisely the same as when 440 miles were interposed and 220 added. So also when 330 miles were added, the deviation of the galvanometer was 18°; and 15° when 330 miles were interposed and 330 added. I have no doubt that the correspondence would have been closer had it not been for the fluctuations of the battery.

It would appear from this, that whatever be the length of wire attached to the insulated pole of a battery, it becomes charged to the same degree of tension throughout its entire extent; so that another insulated wire brought into connexion with its free extremity exhibits precisely the same phenomena, in kind and measure, as when it is brought into immediate connexion with a pole of the battery. Some important practical consequences flow from this conclusion, which I will not develop at present, as I have not yet had an opportunity of submitting them to the test of experiment.

The Strength of Screw Blades; and an Instrument for measuring the Pitch and proving the correct Form of Screw-Propellers, called a Pitch Compass. By James Spence, Chief Foreman of the Steam Factory of H. M. Dockyard, Portsmouth.*

The author stated that the form, length, diameter, and area of the *screw* had all been carefully examined and experimented on, and well authenticated data recorded; but he was not aware that so much attention had been paid to the strength of the *screw blade.* Hence we are frequently hearing of accidents from breakage. The author remarks that in all the broken screws they have had in the navy, the fractures have taken place at about one-third of the length of the blade from the boss. The boomerang of the *Duke of Wellington*, the *Phœnix*, and *Sir Thomas Mitchell*, all broke at about this point. Hence the peculiar converse form of the blade should be carried well out, beyond one-third of the length of the blade. The author then went on to describe a very useful instrument called a pitch compass, for measuring the pitch and proving the correctness of the form of screw-propellers. This machine was suggested by Mr. Rawson, head-master of the School of Shipwright Apprentices at the Dockyard. A chuck provides a centre pivot in the exact line of the axis of the screw. A trammel, made in two pieces, for strength and convenience, is filled with two trap bushes, having holes made to fit on the centre spindle of the chuck. It therefore forms a correct movable base line, at right angles to the axis of the screw. The circular plate on the chuck is divided into twelfths of the circumference, that is, the holes in it are thirty degrees apart. The trammel being secured in one of these holes, a measurement is taken from the trammel, as the base line, to the screw blade by means of a movable pointed rod at right angles to the trammel, and capable of being moved along the trammel as the length of the blade increases. The trammel is then moved to the next hole in the circular plate of the chuck and secured, it having passed through thirty degrees. A second measurement is then taken from the trammel to the screw blade, when the difference in inches between the first and second measurement will be equal to the whole pitch in feet, and so on, so that by indicating the commencement and end of the measurement, by rings clamped on the movable pointed rod, and measuring the alternate distances between them in inches, we get the whole pitch of the screw in feet.

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*From the Lond. Civ. Eng., and Arch. Journal, August, 1855.

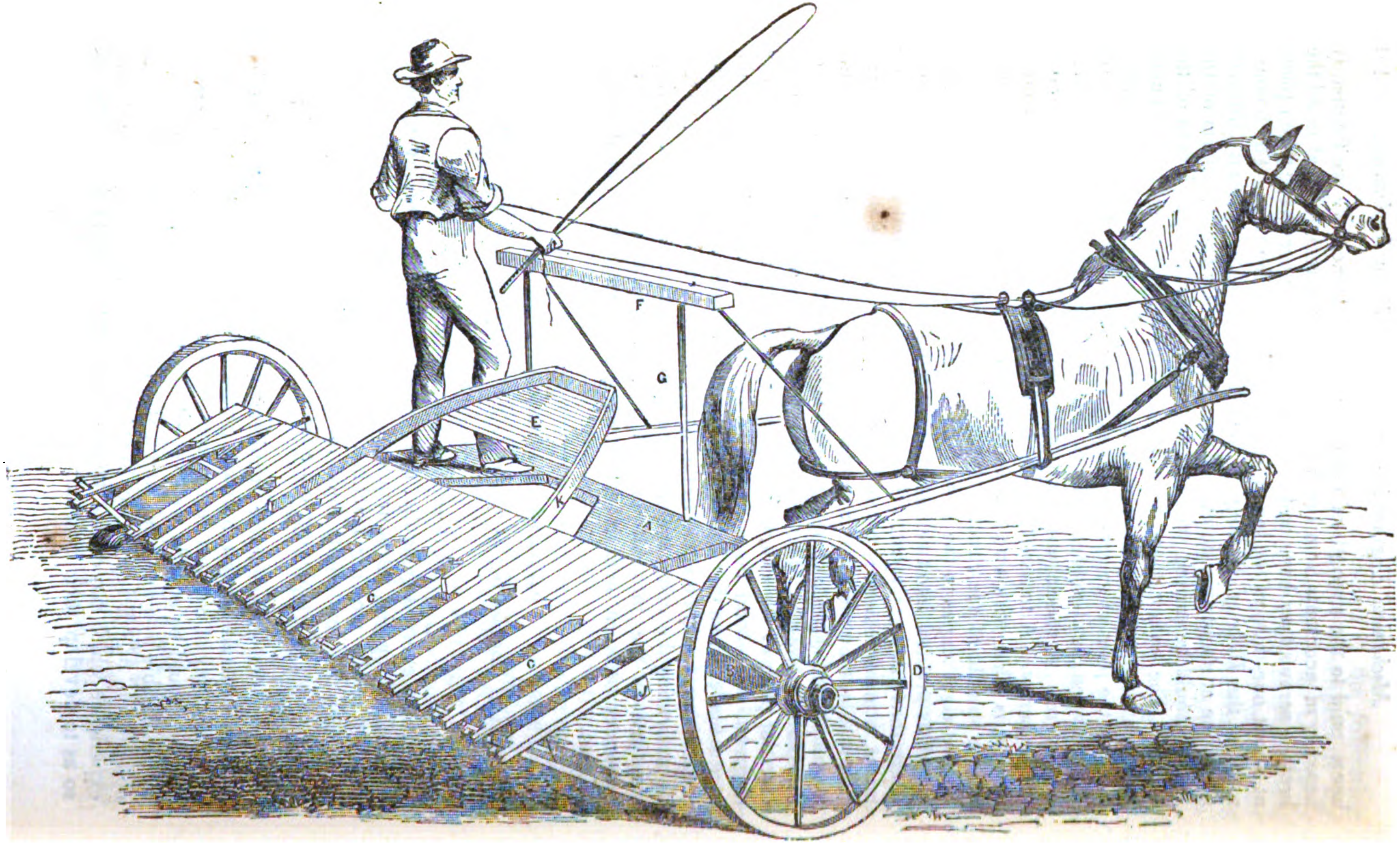
For the Journal of the Franklin Institute.

Mechanical Engineering as applied to Farm Implements. By H. Howson, Civ. Eng.

(Continued from page 343.)

That necessity is generally, if not always, the parent of invention, is exemplified by the introduction of the horse rake, as a labor saving adjunct of the mowing machine. To keep pace, indeed, by manual labor with the wonderfully rapid movements of the latter, would involve the necessity of employing more farm hands than American ingenuity could tolerate.

One of the indispensable requirements for the designer and builder of farm implements, is a thorough practical familiarity with the strength and durability of various descriptions of wood. It is no less necessary that he should be equally well veresd in the peculiar properties of cast and malleable iron and steel, and a still more important requisite for the completion of efficient agricultural machines is, that forethought and experience which may enable the manufacturer to combine these materials so as to develop their most important and useful qualities.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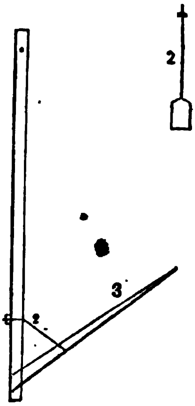
There are few if any contrivances for facilitating farm operations, which are not constructed of iron and wood combined, and the proper arrangement of these materials, consistent with strength, lightness, and durability, is the subject which should form the study of all who wish to excel in this important industrial feature of the age.

The duties to be performed by horse rakes are of such a nature, that the lightest materials may be used in their construction. We consequently find, that with the exception of a few iron rods and fastenings, these implements are generally made entirely of wood.

Of the several horse rakes now commonly used, and all of which are unexceptionable as regards their performance,

The Independent Tooth Rake of C. Delano, Patented in 1849, appears to be one of the most complete, and as a popular machine, especially among the New England farmers, has been here selected for illustration.

In the annexed perspective view of this ingenious implement, A, is a platform secured to the shafts and to the axle tree B, the latter being furnished with light wheels D. To the axletree are secured several bolts with eyes about four inches above the axle, and through these eyes passes an iron rod about half an inch in diameter. C, are a series of wooden bars, about one inch and a quarter thick, five inches wide at the upper end, and two inches wide below. These bars are strung on to the half inch rod, in contact with each other at the top, so as to prevent any lateral movement, but independent of each other as regards vertical movement.



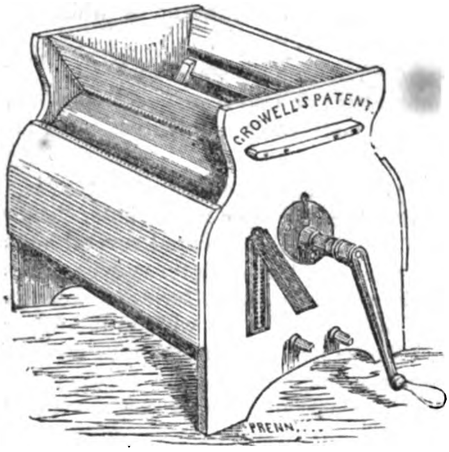
Into the ends of the rods C, are secured the teeth 3, the latter forming an angle of about fifty-six degrees with the former. Wire stays 2, (as seen in the annexed detached view) serve as additional security to the teeth. K, is a triangular wooden frame jointed to eyes on the axle B, between the latter and the rod to which the bars C, are strung. To the end of the frame K, is secured a cross bar J, about three inches by one inch in the centre and tapering towards the ends, the other end of the frame K, which projects about thirty inches in front of the axle, and is furnished with boards E, for the foot of the attendant.

A bar F, is erected on perpendicular rods C, and secured to the shafts by diagonal rods in front of the platform A, and serves as a guard for the driver. Should one of the teeth, as the machine is drawn over the ground, come in contact with a stone, sod, or other obstruction, it will rise from the ground without disturbing the neighboring teeth. When sufficient hay has been collected by the machine, the driver places one foot on the platform E, of the triangular frame K, and depressing the same, causes the cross bar J, to elevate the whole row of teeth, when the hay is released, after which the driver removes his foot and proceeds as before.*

The price of Delano's horse rake is 22 dollars.

Allusion has been previously made to the multiplicity of churns patented and in common use throughout the Union. To give a succinct or even a passing account of the merits and features of such a host of these useful farm implements would occupy more space than the nature of these papers would allow. A perspective sketch of

Crowell's Patent Thermometer Churn, as Manufactured by Messrs. Landreth & Sons,



However, is here introduced as an instrument worthy of notice as well for its popularity as its ingenuity.

One of the features of this churn, is a double semicircular bottom of two sheets of zinc or other suitable material, placed one above the other, the cream resting on the uppermost. Between the two semicircular sheets is a space into which may be introduced cold or warm water, to increase or diminish the temperature of the cream above. Another feature in this churn is the application of a thermometer placed permanently at one end and entirely secured from breakage or other accident. This thermometer is marked at 62 degrees, at which temperature the cream may be maintained by pouring hot or cold water into the space between the two sheets of metal.

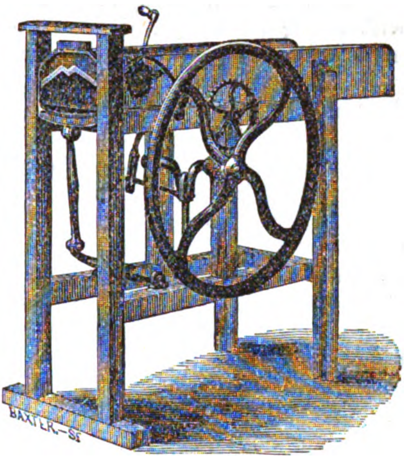
Inside the churn are two simple arms projecting from each end of, and at right angles to, the axis, and across the ends of these arms are secured the beaters.

In operating the churn, the crank handle is turned at the rate of about forty revolutions per minute.

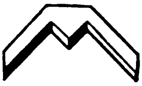
The above contrivance certainly possesses the advantage of enabling the operator to keep the cream definitely at the desired temperature without intermixing it with water or other substances. The price varies from $2·50 to $12.

Straw Cutter, Patented by C. W. Seeley of Albany, and Manufactured by Messrs. Landreth of this City.

The variety of straw and hay cutters is little short that of churns. Among the latest of the inventions and new contrivances for this purpose is one patented by C. W. Seeley of Albany, and manufactured by Messrs. Landreth of this City. This straw cutter, represented in the annexed perspective sketch, consists of a frame three feet high and one foot wide, supporting a box to hold the straw to be cut, the box being three and a half feet long, five inches deep, thirteen inches wide at one end, and eight inches at the other. At the narrow end are a pair of fluted rollers driven by ratchets and pinions moved by a crank on the fly wheel shaft under the box. The fly wheel is of iron, two and a half feet across, and with a rim one inch and a quarter in diameter, and weighing about forty pounds, and is driven by a spur wheel about eight inches across on the end of the shaft, to which the driving handle is secured; the latter is thirteen inches long and is on the right hand side of the box, the fly wheel being on the left. From the fly wheel crank a rod eight inches long extends down to a lever sixteen inches long and hung to the lower part of the frame. From the other end of this lever another rod extends up to the knife frame, which is of cast iron, and supports a knife of the shape illustrated in the annexed cut.



As the handle is turned, the straw or corn stalks are drawn forward by the rollers and held over a square iron edge, when the knife comes down with a shearing cut and with power enough to cut the thickest corn stalk in two.



The point in the middle of the knife is the great feature of the improvement. The straw becoming crowded in a compact mass, by using a common inclined knife without this point is apt to cut hard. By using a knife of the above shape, however, the point begins to enter and cut with but little effort at the precise spot where, without it, the machine would require the greatest power to make the cut. There is another advantage in this knife. The point is so strong and the momentum so great, that a seasoned root or stock would be split and cut in two without checking the machine.

The retail price of this efficient instrument is twelve dollars.

(To be Continued.)

TWENTY-FIFTH MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.*

An Account of some Experiments with a Large Electro-Magnet. By Mr. Joule.—Prof. W. Thomson, in Mr. Joule's absence, brought the subject before the Section.—The relation of the exciting force to the sustaining power of a magnet was the subject which it was the author's desire to examine, the laws arrived at being very divergent from those usually received. The soft iron made use of in this magnet, was of such a nature that it always—probably on account of intense magnetization on some former occasion—retained a residual polarity which was always in the same direction. The magnet might be excited by a current which developed a polarity opposed to the residual one; but, on the interruption of the current, the latter re-appeared. With high power, the lifting power fell short of being proportional to the square of the current; but with feeble excitation, Mr. Joule found the sustaining force to vary as the fourth or fifth power of the current strength employed.

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*From the Lond. Athenæum, September, 1855.

Dr. Robinson gave an account of some of his own experiments on this subject, which confirmed those of Mr. Joule. The magnet made use of in his experiments consisted of two upright pillars of soft iron, with a movable crosspiece of thesame metal, which enabled him to vary the length of the limbs of the magnet. To determine the lifting power, a keeper, or sub-magnet, accurately planed, was placed across from pole to pole of the magnet, and, by a suitable mechanical arrangement, the force necessary to separate it from the excited magnet was determined. An approach to the point of magnetic saturation soon manifested itself, and, in this respect, the experiments of Prof. Robinson were quite confirmatory of those of Mr. Joule.—Prof. Tyndall remarked that he had sometimes been surprised to observe the comparatively low power of excitement in Mr. Joule's experiments at which the approach to magnetic saturation was exhibited. In Müller's experiments, where thick bars of iron were used, it required very strong excitation to produce the falling off, from the law that the magnetic attraction is proportional to the square of the exciting current. In Mr. Joule's experiments masses of soft iron were made use of, of far greater size than those used by Müller, but nevertheless the falling off from the law alluded to soon exhibited itself. In the remarks which had been brought before the Section, the shape of the magnet was omitted as an element in the question; but in all probability, it would be found that if one of the limbs of Dr. Robinson's magnet were employed alone as a straight bar, its magnetism being measured by its action upon a freely suspended magnetic needle, instead of by its lifting power, the magnetic saturation of the bar would be much more difficult of attainment. Or even preserving the form of experiment made use of by Dr. Robinson, and introducing a plate of non-magnetic matter one-tenth or one-hundredth of an inch in thickness between the keeper and the magnet, a totally different law of lifting power would be obtained; the magnetic attraction in the last case would preserve its proportionality with the square of the current for a much longer period. A current which would appear to saturate the magnet in Dr. Robinson's experiments would not saturate in the latter case; and there does not appear to be any sufficient reason for accepting the latter result in preference to the former as expressive of the absolute capacity of the magnet for magnetization.—Dr. Robinson observed in reply, that he believed his method of experiment preferable to that suggested by Prof. Tyndall for the special object in view. He regarded the disruption of direct contact better calculated to throw light on the true state of the magnet than the separation of the keeper where an interval existed between it and the magnet. He had actually introduced such an interval as that spoken of by Prof. Tyndall, and it was true that he had found a totally different law from that arrived at when magnet and sub-magnet were in contact.

On Peristaltic Induction of Electric Currents in Submarine Telegraph Wires. By Prof. Thomson.—Recent examinations of the propagation of electricity through wires in subaqueous and subterranean telegraph cables, have led to the observation of phenomena of induced electric currents, which are essentially different from the phenomena (discovered by Faraday many years ago) of what has hitherto been called electro-dynamic, or electro-magnetic induction, but which, for the future, it will be convenient to designate exclusively by the term electro-magnetic. The new phenomena present a very perfect analogy with the mutual influences of a number of elastic tubes, bound together laterally throughout their lengths, and surrounded and filled with a liquid which is forced through one or more of them, while the others are left with their ends open or closed. The hydrostatic pressure applied to force the liquid through any of the tubes will cause them to swell, and to press against the others, which will thus, by peristaltic action, compel the liquid contained in them to move in different parts of them in one direction or the other. A long solid cylinder of India-rubber, bored symmetrically in four, six, or more circular passages parallel to its length, will correspond to an ordinary telegraphic cable containing the same number of copper wires, separated from one another only by gutta percha; and the hydraulic motion will follow rigorously the same laws as the electrical conduction, and will be expressed by identical language in mathematics, provided the lateral dimensions of the bores are so small, in comparison with their lengths, or the viscocity of the fluid so great, that the motions are not sensibly affected by inertia, and are consequently dependent altogether on hydrostatic pressure and fluid friction. Hence the author considers himself justified in calling the kind of electric action now alluded to, *peristaltic induction*, to distinguish it from the electro-magnetic kind of electro-dynamic induction. The mathematical treatment of the problem of mutual peristaltic induction is contained in the paper brought before the Section; but the author confined himself in the meeting to mentioning some of the results. Among others, he mentioned, as being of practical importance, that the experiments which have been made on the transmission of currents backwards and forwards by the different wires of a multiple cable, do not indicate correctly the degree of retardation that is to be expected when signals are to be transmitted through the same amount of wire laid out in a cable of the full length. It follows, that expectations as to the working of a submarine telegraph between Britain and America, founded on such experiments, may prove fallacious; and to avoid the chance of prodigious losses in such an undertaking, the author suggested that the working of the Varna and Balaklava wire should be examined. He remarked that a part of the theory communicated by himself to the Royal Society last May, and published in the Proceedings, shows that a wire of six times the length of the Varna and Balaklava wire, if of the same lateral dimensions, would give thirty-six times the retardation, and thirty-six times the slowness of action. If the distinctness of utterance and rapidity of action practicable with the Varna and Balaklava wire are only such as to be not inconvenient, it would be necessary to have a wire of six times the diameter; or better, thirty-six wires of the same dimensions; or a larger number of still smaller wires twisted together, under a gutta percha covering, to give tolerably convenient action by a submarine cable of six times the length. The theory shows how, from careful observations on such a wire as that between Varna and Balaklava, an exact estimate of the lateral dimensions required for greater distances, or sufficient for smaller distances, may be made. Immense economy may be practised in attending to these indications of theory in all submarine cables constructed in future for short distances; and the non-failure of great undertakings can alone be *insured* by using them in a preliminary estimate.

Experimental Observations on an Electric Cable. By Mr. Wildman Whitehouse.—After referring to the rapid progress in submarine telegraphy which the last four years have witnessed, Mr. Whitehouse said that he regarded it as an established fact that the nautical and engineering difficulties which at first existed had been already overcome, and that the experience gained in submerging the shorter lengths, had enabled the projectors to provide for all contingencies affecting the greater. The author then drew the attention of the Section to a series of experimental observations which he had recently made upon the Mediterranean and Newfoundland cables, before they sailed for their respective destinations. These cables contained an aggregate of 1125 miles of insulated electric wire,—and the experiments were conducted chiefly with reference to the problem of the practicability of establishing electric communications with India, Australia, and America. The results of all the experiments were recorded by a steel style upon electro-chemical paper by the action of the current itself, while the paper was, at the same time, divided into seconds and fractional parts of a second by the use of a pendulum. This mode of operating admits of great delicacy in the determination of the results, as the seconds can afterwards be divided into hundreds by the use of a "vernier," and the result read off with the same facility as a barometric observation. Enlarged fac-similes of the electric autographs, as the author calls them, were exhibited as diagrams, and the actual slips of electro-chemical paper were laid upon the table. The well known effects of induction upon the current were accurately displayed; and contrasted with these were other autographs, showing the effect of forcibly discharging the wire by giving it an adequate charge of the opposite electricity in the mode proposed by the author. No less than eight currents—four positive and four negative—were in this way transmitted in a single second of time through the same length of wire (1125 miles) through which a single current required a second and a half to discharge itself *spontaneously* upon the paper. Having stated the precautions adopted to guard against error in the observations, the details of the experiments were then concisely given, including those for "velocity," which showed a much higher rate attainable by the magneto-electric than by the voltaic current. The author then recapitulated the facts, to which he specially invited attention:—First, the mode of testing velocity by the use of a voltaic current divided into two parts (a split current), one of which shall pass through a graduated resistance tube of distilled water, and a few feet only of wire, while the other part shall be sent through the long circuit, both being made to record themselves by adjacent styles upon the same slip of electro-chemical paper. Second, the use of magneto-electric "twin currents," synchronous in their origin, but wholly distinct in their metallic circuits, for the same purpose, whether they be made to record themselves direct upon the paper, or to actuate relays or receiving instruments which shall give contacts for a local printing battery. Third, the effects of induction, retardation of the current, and charging of the wire, as shown autographically; and contrasted with this—fourth, the rapid and forcible discharging of the wire by the use of an opposite current; and hence—fifth, the use of this as a means of maintaining, or restoring at pleasure, the electric equilibrium of the wire. Sixth, absolute neutralization of currents by too rapid reversal. Seventh, comparison of working speed attainable in a given length of wire by the use of repetitions of similar voltaic currents as contrasted with alternating magneto-electric currents, and which, at the lowest estimate, seemed to be seven or eight to one in favor of the latter. Eighth, proof of the co-existence of several waves of electric force of opposite character in a wire of given length, of which each respectively will arrive at its destination without interference. Ninth, the velocity, or rather amount of retardation, greatly influenced by the energy of the current employed, other conditions remaining the same. Tenth, no adequate advantages obtained in a 300-mile length by doubling or trebling the mass of conducting metals. The author, in conclusion, stated his conviction that it appeared from these experiments, as well as from trials which he had made with an instrument of the simplest form, actuated by magneto-electric currents, that the working speed attainable in a submarine wire of 1125 miles was ample for commercial success. And may we not, he added, fairly conclude also that India, Australia, and America, are accessible by telegraph without the use of wires larger than those commonly employed in submarine cables?

Note on Solar Refraction. By Prof. Piazzi Smyth.—Amongst other interesting and important consequences of the dynamical theory of heat, Prof. W. Thomson having deduced the necessity of a resisting medium, the condensation of this about the sun, and a consequent refraction of the stars seen in that neighbourhood. Prof. Piazzi Smyth had endeavored to ascertain by direct astronomical observation, whether any such effect was sensible to our best instruments. Owing to atmospheric obstructions, only three observations, yielding two results, had been yet obtained; but both these indicated a sensible amount of solar refraction. Should this effect be confirmed by more numerous observations, it must have important bearings on every branch of astronomy; and as the atmosphere at all ordinary observatories presents almost insuperable obstacles, the author pointed out the advantage of stationing a telescope for this purpose on the summit of a high mountain.

Remarks on the Chronology of the Formations of the Moon. By Prof. Nichol.—Prof. Nichol stated that, through the munificence of the Marquis of Breadalbane, he had been enabled to bring to bear on the delicate inquiries, whose commencement he intended to explain, a very great, if not a fully adequate, amount of telescopic power. A speculum of twenty-one inches, originally made by the late Mr. Ramage with the impracticable focal length of *fifty-five feet*, had, at the expense of that noble Lord, been re-ground, polished, mounted as an equatorial, and placed in the Glasgow Observatory, in its best state, only about six weeks ago. Prof. Nichol showed some lunar photographs, which indicated the great light with which the telescope endowed its focal images, and entered on other details as to its *definition.* The object of the present paper is the reverse of speculative. It aims to recall from mere speculation, to the road towards positive inquiry, all observers of the lunar surface. To our satellite hitherto those very ideas have been applied, which confused the whole early epochs of our terrestrial geology, the notion, viz: that its surface is a *chaos*, the result of primary, sudden, short-lived, and lawless convulsion. We do not now connect the conception of irregularity with the history of the earth :—it is the triumph of science to have analyzed that apparent chaos, and discerned order through it all. The mode by which this has been accomplished, it is well known, has been the arrangement of our terrene mountains according to their relation to time: their relative ages determined, the course of our world seemed smooth and harmonious, like the advance of any other great organization. Ought we not then to attempt to apply a similar mode of classification to the formations in the moon,—hoping to discern there also a course of development, and no confusion or manifestation of irregular convulsion? Prof. Nichol then attempted to point out that there appeared a practical and positive mode by which such classification might be effected. It could not, in so far as he yet had discerned, be accomplished by tracing, as we had done on earth, relations between lunar upheavals and stratified rocks; but another principle was quite as decisive in the information it gave, viz: the intersection of dislocations. There are clear marks of dislocation in the moon—nay, the surface of our satellite is overspread with them. These are the rays of light, or rather bright rays, that flow from almost all the great craters as their centres, and are also found where craters do not at present appear. Whatever the substance of this highly reflecting matter, it is evidently no superficial layer or stream, like lava, but extends downwards a considerable depth into the body of the moon. In short, we have no likeness to it on earth, in the sense now spoken of, except our great trap and crystalline *dykes.* It seemed clear, then, that the intersection of these rays are really *intersections of dislocations*, from which we might deduce their chronology. Can the intersection, however, be sufficiently seen?—In other words, is the telescope adequate to determine which of the two intersecting lines has disturbed or cut through the other? Prof. Nichol maintained the affirmative in many cases, and by aid of diagrams, taken down from direct observation, illustrated and enforced his views.

On the Achromatism of a Double Object-Glass. By Prof. STOKES.—The general theory of the mode of rendering an object-glass achromatic, by combining a flint-glass with a crown-glass lens, is well known. The achromatism is never perfect, on account of the irrationality of dispersion. The defect thence arising cannot possibly be obviated except by altering the composition of the glass. It seemed worthy of consideration, whether much improvement might not be effected in this direction; but the problem which the author proposed for consideration was only the following:—Given the kinds of glass to be employed, to find what ought to be done so as to produce the best effect; in other words, to determine the ratio of the focal lengths which gives the nearest approach to perfect achromatism. Two classes of methods may be employed for this purpose. In the one, compensations are effected, by trial, on a small scale; in the other, the refractive indices of each kind of glass are determined, for certain well defined objects in the spectrum, such, for example, as the principal fixed lines. The former has this advantage, that compensations on a small scale do not furnish so delicate a test as the performance of a large object-glass. The observation of refractive indices, on the other hand, admits of great precision; but it does not immediately appear what ought to be done with the refractive indices when they are obtained. After alluding to the method proposed by Fraunhofer for combining the refractive indices, which, however, as he himself remarked, did not lead to results in exact accordance with observation, the author proposed the following as the condition of nearest approach to achromatism:—that the point of the spectrum, for which the focal length of the combination is a minimum, shall be situated at the brightest part, namely, at about one-third of the interval D E from the fixed line D, towards E. The refractive index of the flint glass may be regarded as a function of the refractive index of the crown glass, and may be expressed with sufficient accuracy by a series with three terms only. The three arbitrary constants may be determined by the values of three refractive indices, determined for each kind of glass. On applying the resulting formula to calculate r, (the ratio of the chromatic changes of the indices of refraction,) for the object-glass, for which Fraunhofer has given both the refractive indices of the component glasses and the value of r, which, as observation showed, gave the best results, and taking in succession various combinations, of three lines each, out of the seven used by Fraunhofer, the author found that, whenever the combination was judiciously chosen, the resulting value of r was the same, whatever might have been the combination, and equal to 1·980, which is precisely the value determined by Fraunhofer, from observation, as giving the best effect.

On the Polar Decomposition of Water by Frictional and Atmospheric Electricity. By Prof. Andrews.—The author having drawn attention to the fact, that water had never been decomposed by the action of the common friction electricity, so as to collect the gases and exhibit them at the opposite poles, stated that the cause of the failure of the experiment was the solution of the gases in the mass of the liquid. By fusing platina wires in thermometer tubes, this difficulty is avoided, and the gases may be then obtained and collected with the same facility as in ordinary eudiometric experiments. By arranging a series of such tubes, the operations may be almost indefinitely repeated. On raising an electrical kite, the author succeeded in obtaining the polar decomposition of water by atmospheric electricity. The observations were made in fine weather, when the atmosphere was not usually charged with electricity. Although the gases were easily collected and measured, from the delicate form of apparatus employed, the quantity of water decomposed in this case amounted only to one 700,000th of a grain in the hour.

On the Phosphorescence and Composition of Plate-Sulphate of Potash. By Prof. Penny.—The subject of this paper is a chemical product from kelp. It is called plate-sulphate of potash from the circumstance of its being crystallized in thick plates or slabs, consisting of the aggregate layers of successive crops of crystals. Beautiful specimens of the salt, supplied by Mr. Paterson, one of the most extensive manufacturers of kelp products in Glasgow, were exhibited to the Section. There are several points in the chemical history of this salt possessing a high degree of scientific interest. The principal points alluded to by the author of the paper were, first, the peculiarity of the process by which it is obtained in slabs or slates; second, the brilliant phosphorescence of its crystals at the time of their formation; and third, its remarkable composition. The mode of obtaining it was fully explained, and the various circumstances that influence the emission of light from the salt, at the time of crystallizing, were minutely described.

On a new Form of Cyanic Acid. By Baron Liebig.—In the course of some experiments on the fulminate of mercury, I observed that that compound, when kept boiling in water, changed its color, and lost its fulminating properties. On examining the change that had taken place in the composition of the fulminate, I discovered a new acid which had exactly the composition of cyanuric acid, but which differed entirely from that acid in its properties, and in the properties of the salts which are produced with the alkaline bases—salts remarkable for their beauty and for the distinctness of their crystalline form. Taking for the equivalent of hydrated fulminic acid the formula C^2, NO, HO, the new acid is produced in a very similar manner. The elements of three equivalents of fulminic acid unite to form one equivalent of the new acid, to which I shall give the name of fulminuric acid. This acid is monobasic. Its salt of silver is soluble in hot water, and crystallizes from it in long, silky, white needles. The alkaline salts of the new acid are very easily prepared by boiling the fulminate of mercury with an alkaline chloride. The fulminate of mercury is first dissolved; then gradually two-thirds of the oxide of mercury precipitates, and the alkaline fulminate, with a certain quantity of chloride of mercury and potassium, remains in the solution. By employing the chloride of sodium, or the chloride of barium, we obtain, of course, a salt of the new acid, with a base of soda or of barytes. With chloride of ammonium an ammoniacal salt is obtained, the crystals of which are distinguished from all others by their adamantine brilliancy, and their high degree of power and lustre. These crystals belong to the Klinerhombic system, and possess double refraction almost as strongly as Iceland spar. The hydrated acid is easily obtained by decomposing the basic lead salt by means of sulphuretted hydrogen. It has a strongly acid re-action, and when reduced by evaporation to a state of syrup, it is transformed by degrees into a crystalline mass, which dissolves in alcohol, and which, by the action of acids, is changed into carbonic acid and ammonia.

On the Extraction of Metals from the Ore of Platinum. By M. Fremy.—M. Frémy treated of the preparation of osmium, rhodium, and iridium, from the residues of the platinum ores. The preparation of osmium according to the old method is attended with great difficulties and actual danger. M. Frémy proposed to prepare osmium by passing atmospheric air over the residual ore, heated in a porcelain tube. The volatile osmic acid is condensed in glass balloons, and the less volatile oxide of rathenium is found at the extremity of the heated tube. The rhodium remaining in the residual mass is separated from the other metal contained by chlorine gas at a high temperature.

On the Allotropic Modifications of Chlorine and Bromine analogous to the Ozone from Oxygen. By Prof. ANDREWS, who explained that ozone could be produced, first, by an electric spark; secondly, by the decomposition of acids and solutions, when coming into contact with the galvanic wire; and lastly, by oxidation.

On a Process for obtaining Lithographs by the Photographic Process. By Prof. RAMSEY.—Prof. Ramsey described a process by which Mr. Robert M'Pherson, of Rome, had succeeded in obtaining beautiful photolithographs.—specimens of which had been hung up in the Photographic Exhibition in Buchanan Street. The steps of the process are as follows: —1. Bitumen is dissolved in sulphuric acid, and the solution is poured on an ordinary lithographic stone. The ether quickly evaporates, and leaves a thin coating of bitumen spread uniformly over the stone. This coating is sensitive to light, a discovery made originally by Mr. Niepce, of Chalons. 2. A negative on glass, or waxed paper, is applied to the sensitive coating of bitumen, and exposed to the full rays of the sun for a period longer or shorter according to the intensity of the light, and a faint impression on the bitumen is thus obtained. 3. The stone is now placed in a bath of sulphuric ether, which almost instantaneously dissolves the bitumen, which has not been acted upon by light, leaving a delicate picture on the stone, composed of bitumen on which the light has fallen. 4. The stone, after being carefully washed, may be at once placed in the hands of the lithographer, who is to treat it in the ordinary manner with gum and acid, after which proofs may be thrown off by the usual process.—Prof. Ramsey then proceeded to state that the above process, modified, had been employed with success to etch plates of steel or copper, without the use of the burin:—1. The metal plate is prepared with a coating of bitumen, precisely in the manner noticed above. 2. A positive picture on glass or paper is then applied to the bitumen, and an impression is obtained by exposure to light. 3. The plate is placed in a bath of ether, and the bitumen not acted upon by light is dissolved out. A beautiful negative remains on the plate. 4. The plate is now to be plunged into a galvano-plastic bath, and gilded. The gold adheres to the bare metal that refuses to attach itself to the bitumen. 5. The bitumen is now removed entirely by the action of spirits and gentle heat. The lines of the negative picture are now represented in bare steel or copper, the rest of the plate being covered by a coating of gold. 6. Nitric acid is now applied as in the common etching process. The acid attacks the lines of the picture formed by the bare metal, but will not bite into the gold surface. A perfect etching is thus obtained.

On Writing Inks.[*] By JAMES STARK, M. D., F.R. S. E.

The author stated that in 1842, he had commenced a series of experiments on writing inks, and up to this date had manufactured 229 different inks, and tested the durability of writings made with these on all kinds of paper. As the result of his experiments, he showed that the browning and fading of inks, resulted from many causes, but in ordinary inks chiefly from the iron becoming peroxygenated, and separating as a heavy precipitate. Many inks, therefore, when fresh made, yielded durable writings; but when the ink became old, the tannogallate of iron separated, and the durability of the ink was destroyed. From a numerous series of experiments, the author showed that no salt of iron and no preparation of iron equalled the common sulphate of iron, that is, the commercial copperas, for the purposes of ink-making, and that even the addition of any persalt, such as the nitrate or chloride of iron, though it improved the present color of the ink, deteriorated its durability. The author failed to procure a persistent black ink, from manganese or other metal or metallic salt. The author exhibited a series of eighteen inks, which had either been made with metallic iron, or with which metallic iron had been immersed, and directed attention to the fact that, though the depth and body of color seemed to be deepened, yet in every case the durability of writings made with such ink was so impaired, that they become brown and faded in a few months. The most permanent ordinary inks, where shown to be composed of the best blue gall-nuts with copperas and gum, and the proportions found on experiment to yield the most persistent black, were six parts of best blue galls to four parts of copperas. Writings made with such an ink, stood exposure to sun and air for twelve months, without exhibiting any change of color, while those made with inks of every other proportion or composition, had more or less of their color discharged when similarly tested. This ink, therefore, if kept from moulding and depositing its tannogallate of iron, would afford writings perfectly durable. It was shown that no gall and logwood ink was equal to the pure gall ink, in so far as durability in the writings was concerned. All such inks lost their color and faded sooner than pure gall inks, and several inks were exhibited, which, though durable before the addition of logwood, faded rapidly after logwood was added to them. Sugar was shown to have an especially hurtful action on the durability of inks containing logwood—indeed on all inks. Many other plain inks were exhibited, and their proportions described—as gallo-sumach ink, myrobalans ink, Range's ink,—inks in which the tannogallate of iron was kept in solution by nitric, muriatic, sulphuric, and other acids, or by oxalade of potash, chloride of lime, &c. The myrobalans ink was recommended as an ink of some promise for durability, and as the cheapest ink it was possible to manufacture. All ordinary inks, however, were shown to have certain drawbacks, and the author endeavored to ascertain by experiment, whether other dark substances could be added to inks, to impart greater durability to writings made with them, and at the same time prevent those chemical changes which were the cause of ordinary inks fading. After experimenting with various substances, and, among others, with Prussian blue and indigo dissolved in various ways, he found the sulphate of indigo to fulfil all the required conditions; and, when added in the proper proportion to a tannogallate ink, it yielded an ink which is agreeable to write with, which flows freely from the pen, and does not clog it, which never moulds, which, when it dries on the paper, becomes of an intense pure black, and which does not fade or change its color, however long kept. The author pointed out the proper proportions for securing these properties, and showed that the smallest quantity of the sulphate of indigo which could be used for this purpose, was eight ounces for every gallon of ink. The auther stated that the ink he preferred for his own use was composed of twelve ounces of galls, eight ounces of sulphate of indigo, eight ounces of copperas, a few cloves, and four or six ounces of gum-arabic, for a gallon of ink. It was shown that immersing iron wire or filings in these inks, destroyed their durability as much as similar treatment destroyed ordinary inks. He therefore recommended that *all legal deeds or documents should be written with quill pens*, as the contact of steel invariably destroys more or less the durability of every ink. The author concluded his Paper with a few remarks, on copying inks, and indelible inks, showing that a good copying ink has yet to be sought for, and that indelible inks, which will resist the pencilings and washings of the chemist, and the forger, need never be looked for.

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[*] From the Lond. Civ. Eng. and Arch. Jour., August, 1855.

In Openwork Girders, with Braces alternately Perpendicular and Oblique. To determine that value of the Angle θ (which the oblique braces make with a vertical line) that will produce the greatest economy in the weight or cost of the bracing. By R. H. Bow, Civ. Eng.*

Though we confine our attention in the following investigation to fig. 2, the results are equally applicable to fig. 1.

FIG I

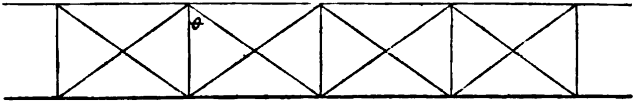
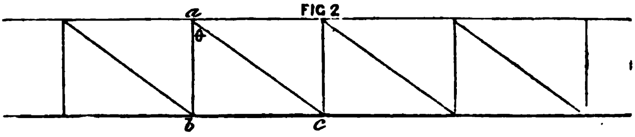


FIG 2



Let the weight (or cost, according as lightness or cheapness is sought after) of a unit of length of a perpendicular brace, capable of conveying a unit of strain, compressive or tensile as the case may be, $\div$ The weight (or cost) of a unit of length of an oblique brace, capable of conveying a unit of strain, tensile, or compressive as the case may be, be $= n$

Let the length *ab* of a perpendicular brace $=$ rad. $= 1$;

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*From the Lond. Civ. Eng. and Arch's. Jour., September, 1855.

Then the length ac of an oblique brace will be $= \sec\theta$;

And the number of perpendicular, or of oblique braces in a given length, L, will be $= \frac{L}{bc} = \frac{L}{\tan\theta}$

The strains in the perpendicular braces, compared with the strains in the oblique braces, will be as rad.: $\sec\theta$; and the weights (or costs) will be as the lengths multiplied by the strains and by the allowance of metal (or cost) for each unit of strain; therefore,

$$\left.\begin{array}{l}\text{The weight, or cost, of one}\\ \text{oblique and of one perpen-}\\ \text{dicular brace}\end{array}\right\} \div \sec\theta \times \sec\theta \times 1 + r \times r \times n$$

$$= \sec^2\theta + n.$$

And multiplying this by $\frac{L}{\tan\theta}$, we get

$$\left.\begin{array}{l}\text{The total weight, or cost,}\\ \text{of the bracing for a length}\\ = \text{L}\end{array}\right\} \div \frac{L\sec^2\theta}{\tan\theta} + \frac{Ln}{\tan\theta} \div \frac{\sec^2\theta}{\tan\theta} + \frac{n}{\tan\theta}$$

$$= \frac{\sec\theta}{\sin\theta} + \frac{n}{\tan\theta}$$

which by the Calculus we find to be a minimum when

$$\tan\theta = \sqrt{1+n}.$$

So that when $n = 0{\cdot}5$, then $\theta = 50^\circ\ 46'\tfrac{1}{2}$
" $n = 1{\cdot}0$, " $\theta = 54^\circ\ 44'$
" $n = 2{\cdot}0$, " $\theta = 60^\circ$

When n is made $= 0$, we get a case analogous to that of Warren's Bridge, in which oblique braces are alone taken into consideration:

$$\text{Thus, } \tan\theta = \sqrt{1+0} \therefore \theta = 45^\circ,$$

the most economical angle for Warren or lattice forms of bracing.

7 South Gray Street, Edinburgh.

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*Utilization of Slag.**

Sir:—Mr. Mushet, in his letter last week, referred to my manufacture of artificial slag, in combination with other manufactures, by using the waste heat (so easily and generally applied) from a reverberatory furnace, for generating steam, &c.

As the ironmasters cannot be prevailed upon to use their slag, and it is not to be expected they will allow others to use their premises (even where the premises would admit), I am driven to the use of artificial slag, to show that we are not entirely dependent on them for an economical and abundant supply, which is practically proved (to some extent) by Messrs. Chance, of Birmingham, with the Rowley ragstone, melted in a reverberatory furnace, as patented by Mr. Adcock, *subsequent* to my first patent for "clay and other plastic materials;" but as that material is confined to certain districts, similar to the ironstone, it is not likely to be generally used. By analysis it will be found that the common brick earths contain the elements of slag, namely, lime, silica, and alumina, and some of them have been taken direct from the pit to the furnace, and run into slag in less than two hours, without requiring any mixture, thereby proving that for general use, either on a *small or large* scale, there is no slag material equal to the common brick earths, which not only establishes the novelty of my first patent, but shows the applicability of the same to every locality, for the purpose of manufacturing numerous articles of unlimited demand; and as slag cannot be manufactured by any process without a loss of about 80 per cent. of heat, which may be applied (on a small scale) to generating steam for grinding corn, tempering, moulding, drying, and burning of common bricks, pipes, tiles, pottery, cement, &c., &c., or used in combination with any other manufacture requiring steam, by making one fire answer the purpose of several, and in many cases making a double use of the tall chimneys, kilns, furnaces, and other buildings now actually in operation in almost every country town in England. Having shown the capability of using the waste heat, I admit it is incumbent on me to show some process in addition to those now before the public, as published by Dr. Smith (*ante*, page 338), by which slag can be manufactured alone, at a profit; I, therefore, beg to submit the following calculations for public opinion and discussion:—

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* From the Lond. Journal of the Society of Arts, July, 1855.

SLAG AS COMPARED WITH SLATE.

Duchess slates, 24 inches by 12 inches, at £12 10s. per thousand, (the price of slate will vary in every locality.)

180 slates at 3d. per slate, 5¼ lbs. each—8cwt. 49 lb., worth £2 5s. =360 square feet of slag, ½-inch thick, 6¼ lbs. per foot, 1 ton worth £2 5s.

360 slates at 3d. per slate, 5¼ lbs. each—16cwt. 98 lbs., worth £4 10s. =720 square feet of slag, ¼-inch thick, 3 lbs. per foot, 1 ton worth £4 10s.

720 slates at 3d. per slate, 5¼ lbs. each—1 ton 13cwt. 84 lbs., worth £9=1440 square feet of slag, ⅛-inch thick, 1½ lbs. per foot, 1 ton worth £9.

One reverberatory furnace will melt 5 tons of raw material in 24 hours, the cost of which cannot exceed the following estimate (on a small scale) suitable to every locality, (on a large scale the expenses in labour would be much less).

	£.	s.	d.
4 tons of coal, at £1 5s. per ton,	5	0	0
8 furnace-men and moulders,	2	0	0
4 packers in ovens,	1	0	0
8 boys,	0	16	0
2 overlookers,	1	0	0
Wear and tear, interest, rent, &c.,	0	15	0
6 tons of raw material (dug on the spot),	0	12	0
Cost of 24 hours in succession,	11	3	0
			3
Cost of 3 days and 3 nights,	33	9	0

	£.	s.	d.	£.	s.	d.
Amount brought forward, . . .				33	9	0
PRODUCE.						
5 tons of manufactured ½-inch slabs . .	11	5	0			
5 tons ditto ¼-inch slabs, . .	22	10	0			
5 tons ditto ⅛-inch slabs, . .	45	0	0			
	£78	15	0			
Profit . . .				45	6	0
				£78	15	0

Slag is particularly adapted for roofing similar to the Crystal Palace, and may be manufactured and used similar to rough glass, with putty and paint, and if so used, the above calculations may be nearly doubled, as they are supposed to be worked as slate. Thin slabs may also be used instead of plastering, as Dutch tile are frequently used, and will admit of papering or painting immediately, and will be found a certain remedy for damp and vermin.

If worked on a large scale, a small blast furnace may be used for melting, the material to be dried by the waste heat, but as it will then be mixed with the fuel in the furnace, it will require refining, and may also at the same time be colored, as fully described in Dr. Smith's paper, (*ante*, page 335.)

Manufacture of Axles and Piston Rods. By JAMES FENTON, Low Moor, York, Civ. Eng., Patentee, Dec. 16, 1854.*

The invention consists in a mode of manufacturing axles, piston rods, and shafts, girders, and other like articles, by rolling up or coiling a plate of iron of any required thickness and size into a compact roll or coil, next bring it to a welding heat in a suitable furnace, and then drawing it to the required shape under a hammer, or by passing it when at a welding heat through a pair of rolls. The welding may be carried completely through or only partially, say half, through the mass; if the latter, a compound axle or other article will thus be formed, neither solid nor hollow, which it will be nearly impossible to break.

The manner in which the invention is performed is as follows:

A plate of iron is selected or prepared, of a suitable length, width, and thickness to form a compact roll or coil, containing sufficient metal for the production of the intended axle or other article. The thickness, and consequently the other dimensions of the plate, will depend upon the quality of the iron employed. This plate is heated to a red heat (when needful), and two or more workmen, with tongs or pinchers, turn up one of the edges; hammermen then bend down this turned-up edge on to the side of the plate, so as to form the commencement of a roll or coil; after which the operation is continued in the same manner until the whole of the plate has been rolled up, after which it may be passed through a pair of rolls, if considered necessary. A compact roll or coil of metal being thus produced, it is heated to the welding heat in an air or other suitable furnace, and then welded and drawn down under a hammer to the form of the axle or other article required to be manufactured. The welding and shaping of the axle or other article may also be performed by passing the roll or coil of metal when at the welding heat between a pair of rollers, having sets of grooves of gradually decreasing diameter, in the manner commonly practised when rolling bars and rods of iron; or the roll or coil may be submitted first to a hammering process, and then passed between grooved rollers until it is reduced to the required shape. The plate of iron employed for forming a coil or roll which is to be manufactured into an axle or other like article may be a compound one, that is, it may be composed of iron of different qualities, and in this case the plate should be so rolled up or coiled as to bring the iron of superior quality at the outer part or surface of the roll or coil. Two or more different qualities of iron may thus be combined in the same axle or other like article. In some cases also a small solid or hollow core o centre may be employed, and the plate of iron may be rolled up or coiled around this core until a mass has been produced of sufficient size for the production of the intended axle or other like article; the process of manufacture is then concluded as above directed. Although in the foregoing description only hand labor is mentioned as the means of rolling up or coiling the plates of iron into a compact roll or coil, in some cases machinery suitably arranged for the purpose may be also made use of.

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* From the Civil Engineer and Architect's Journal, Sept., 1855.

Claim.—The mode of manufacturing axles, piston rods, and shafts, girders, and other like articles, by rolling up or coiling a plate of iron into a compact roll or coil, next bringing this roll or coil to a welding heat, and then drawing it to the required shape under a hammer, or by passing it between rollers, or by a combination of hammering and rolling processes.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, November 15, 1855.

John C. Cresson, President, in the chair.
John F. Frazer, Treasurer.
Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of October.

The Board of Managers and Standing Committees reported their minutes.

Resignations of membership in the Institute by 15 gentlemen were read and accepted.

The candidates for membership in the Institute, (11,) were proposed, and the candidates proposed at the last meeting, (12,) were duly elected.

Dr. Rand exhibited Baker and Desilver's gas burner. It consists of two or more fish-tail jets placed at an angle, so that the flames may unite.

BIBLIOGRAPHICAL NOTICES.

Axonometrical Projections of the most important Geometrical Surfaces. By FERDINAND ENGEL.

A series of very excellent geometrical drawings, intended, however, we imagine, rather as a descriptive catalogue of the corresponding models than for any great independent usefulness. We feel sure, at least, that if there be any student who cannot form in his own mind, without reference to outward figure, a picture of the wave-surface of a light passing through a doubly refracting medium, he will be much more likely to be led astray than to be assisted by the drawing or model, very beautiful although they are, which are here given. For students of descriptive geometry, however, these figures will furnish valuable examples to copy from, as they are well conceived and executed, and comprise some of the most difficult figures for practice.

Explanations and Sailing Directions to accompany the Wind and Current Charts. By M. F. MAURY, LL. D., Lieut. U. S. Navy. 7th Edition, Philadelphia: E. C. & J. Biddle, 1855.

Lieut. Maury has the merit of originating an entirely new field of usefulness in determining the lines of shortest passage across the oceans, by careful collection of ships' logs, and consequent determination of prevailing winds and currents. The earnestness with which a multitude of navigators, both here and abroad, have entered into his scheme, is sufficient proof of the merit of the plan and the credit due to its suggestor. If, in connexion with this system or in any other way, Lieut. Maury can induce our seafaring men, who are, from education and necessity, acute and accurate observers of phenomena, to study the laws which govern these facts, and endeavor to account for them rationally and generally, he will have accomplished a still more important work. The work before us appears to be a highly meritorious effort in this direction, and we hope it will be found to excite the interest of those more directly concerned with the subject of which it treats, and induce them to pursue the subject still farther. While, however, we speak of this production of Lieut. Maury with all the respect which it deserves, we hope for the credit of his department and the title which he bears, that he will, in the eighth edition, (which, we hope, will soon be called for,) review carefully his Physical Geography. A more profound study of what is known on this subject will lead him to considerable changes in his treatise, and to not less considerable improvement in its value.

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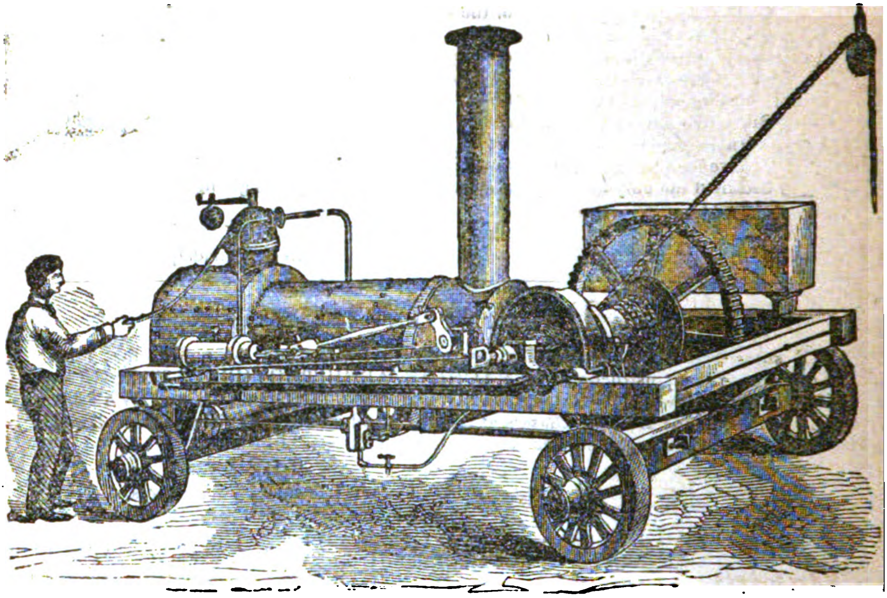

THE FRANKLIN INSTITUTE, at their Exhibitions in 1851 and 1853, awarded a First Premium (Silver Medal) for a PORTABLE STEAM HOISTING AND PUMPING ENGINE, for Loading and Discharging Cargoes, Pile Driving, Raising Iron Ore from Mines, Pumping Water, Driving Ore Washers, &c. Also arranged for driving Portable and Stationary Saw and Grist Mills; several are now in full operation. A First Premium and Diploma was also awarded by the PENN'A. STATE AGRICULTURAL SOCIETY, at their Exhibition at Philadelphia, 1854.

The Engine, which was exhibited at the Franklin Institute in 1851, was purchased by the Philadelphia Gas Company, and used for several months in raising water with elevators and hoisting. This engine having been superseded by another of increased power, in 1852, was afterwards purchased by the Schuylkill Navigation Company. Major Jones has had one in operation on his farm in Cecil County, Maryland, for some months, as a substitute for the horse-power formerly used by him in driving his threshing machine. Another was constructed by order of Pierce Butler, Esq., to be employed on the lands of the North American Coal Company. In 1853, a double cylinder Hoisting Engine was built for the Schuylkill Navigation Co. One for J. J. Holland, of Williston, S. C., with two 8-inch cylinders, for driving a Portable Saw Mill. One for the Philadelphia and Reading Railroad Co., with two 8-inch cylinders, for pumping. One for the Lebanon Furnaces, with two 6-inch cylinders, for hoisting coal and iron. One for the Dauphin and Susquehanna Railroad Co., with two 6-inch cylinders, for hoisting stone, &c., for bridge building. One for the Dauphin and Susquehanna Coal Co., for hoisting and pumping; and one for J. Sterrell & Co., Mifflin, Pa., for driving Barrel machinery.

This machine requires but one man to keep up steam and attend to the brakes. Pig iron can be discharged from a vessel at the rate of 25 tons per honr, and still faster if the hands can get it ready. If the weight while being raised should strike on the combings of the hatchway, the engineer has only to slacken the brake, and it is lowered (without stopping the engine) so as to clear the obstruction; then by drawing the lever connected with the friction brake, tight, the ascending motion is restored. The lowering brake is so arranged that the weight can be suspended at any point required.

References.—Prof. J. C. Cresson, Supt. Phila. Gas Works; Thos. I. Potts, Iron Merchant; Pierce Butler, Esq.; Rob. Kelton, 113 N. Water st.; H. Haupt, Chf. Eng. Penn'a. R. R. Co.; L. G. Mytinger; A. S. & W. L. Roberts, 80½ Walnut St.; Wm. Mahone, Chf. Eng., Norfolk & P. R. R. Co.; S. B. Sutton, St. George's, Del.; C. P. Morton, Mortonville, Chester County, Pa.; Sam'l. Entriken, Paoli, Pa.; Richard Heckaher, Minersville, Pa.; J. Dutton Steel, Esq., Civil Eng. Phila. & Reading R. R. Co.; R. B. Osborn, Chf. Eng. Dauphin & Susq. R. R. Co.; F. Fraley, Pres. Sch. Nav'n Co.; S. A. & W. Henderson, Norristown; Spencer & Mason, Pottsville; G. D. Coleman, Lebanon, Penn.; J. J. Holland, Williston, S. C; Maj. John Jones, Md.

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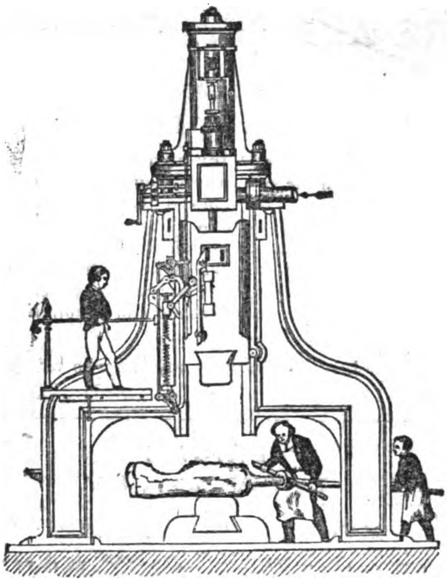

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